The Electrical World.

VOL. XXXI. NEW YORK, APRIL 9, 1898. No. 15.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY,

253 Broadway, New York.

Telephone Call: Cortlandt 924. Cable Address: "Electrical," New York.

New England Office, 620 Atlantic Ave., Boston.
Western Office, 936 Monadnock Block, Chicago.
Philadelphia Office, 929 Chestnut Street.

SUBSCRIPTION IN ADVANCE, ONE YEAR, $3.00,

In the United States, Canada or Mexico; other foreign countries, $6.00.

In requesting your address changed give OLD as well as new address.

Now in its third decade, THE ELECTRICAL WORLD is the Pioneer Electrical Journal of America, and has well maintained its lead. It has the largest Circulation of any electrical periodical, and is the best Advertising Medium.

THE ELECTRICAL WORLD'S Advertising Rates are much lower than those of any other similar publication, circulation considered, and vary according to space, position and number of insertions. Quotations promptly furnished.

Address and make drafts, orders, etc., payable to

THE ELECTRICAL WORLD,

253 Broadway, New York.

VOL. XXXI. NEW YORK, APRIL 9, 1898. No. 15.

CONTENTS.

Editorials 433
Lowering Transformers for Niagara Power, by J. S. Peck 435
The Economical Use of Exhaust Steam, by A. H. Perkins 438
An Isolated Plant in Railroad Shops 439
Station Photometry, by Buckner Speed 440
The Electric Equipment of the Cruiser "Chitose," by G. W. Dickie 442
Report of the Hamilton Electric Lighting Plant 444
The Annual Report of the American Bell Telephone Company 445
Digest of Current Electrical Literature, compiled by Carl Hering 446
Book Review 450
New Form of Enclosed Arc Lamp 450
Straight Sided Power Press 451
Mooring Boats by Electro-Magnetism 451
Direct Connected Generators 451
Alternating Fan Motors 452
Direct-Coupled Unit 452
Departments:
Financial Intelligence 453
Special Correspondence 453
General News 456
Trade and Industrial Notes 45
Business Notices 459
Illustrated Record of Electrical Patents 459

OPEN VERSUS ENCLOSED ARCS.

The enclosed arc has encroached upon its predecessor, the open arc, until it is now making raids in the very stronghold of the latter, namely, the series constant current circuit. The enclosed arc has an advantage in the uniformity of its light, both with respect to time and direction; in other words, it gives not only a steady light, but a light well distributed. Its light is also less dazzling and more pleasant to the eye and obliterates dark backgrounds less than does that of the open arc. For constant-potential work it has practically rung the knell of the open arc, owing in part to the necessity of running the latter in sets of two to obtain any kind of economy.

The enclosed arc can be adjusted over a wide range of distance between carbons, giving a correspondingly wide range of voltage between terminals. It is generally run, however, at a considerably higher voltage than is the open arc, and with a correspondingly smaller current. When so used on series circuits it limits the capacity of an arc light generator to a correspondingly smaller number of lamps. The arc light generators with open arcs being restricted by the limitations of safety to life and property to a size far smaller than that most desirable for economy of installation and operation, this further limitation is a serious objection. On the other hand, where large generators are not wanted, the number of lights being small, as in isolated plants, etc., the reduction of line current means a corresponding reduction of copper or line loss. It might be possible, however, to run the enclosed arc very short and thereby reduce its voltage below that of the open arc, which would incidentally diminish its consumption of watts per candle-power.

For constant-potential working, no arc can be drawn so as to maintain the full difference of potential of the circuit across the carbons. This is due to the unstable equilibrium of the current, an arc having a virtual resistance that is apparently negative; in other words, if the current increases the resistance becomes less, and the current tends to increase still more, and vice versa. A series resistance has to be inserted to render the total effect of everything that resists the flow of current through the arc of such a nature that an increase of current is opposed by an increase of the resisting action, and thus to bring the strength of the current flowing to stable equilibrium. If the resistance to a flow of current across the enclosed arc, or, to use the terminology of a theory abandoned by many, the combination of back E. M. F. and the resistance of the enclosed arc, gives a more stable quantity than that of the open arc, the former may be run on constant-potential circuits with less dead resistance, and hence, may be run more efficiently. Experiments on this point and also further experiments on the relative efficiency of illumination of open and enclosed arcs would be of value.

ELECTRICITY IN COAST DEFENSE.

The military and naval applications of electricity are, at present, practically confined to signaling, lighting, the firing of explosives, and the transmission of power on shipboard. Even in these restricted applications it does not find a very extended use and its recognition as a valuable auxiliary in military operations seems to be slow. In certain minor applications, such as range finders and the driving and steering gear of automobile torpedoes it has been utilized with excellent results, but it is unfortunately true that the navy is still experi-

menting with hydraulic and pneumatic transmissions, that the army is ill provided with portable search lights, and that the fortifications of our greatest harbor are not connected together by telegraph or telephone, save over privately owned land lines.

Some of the fortifications in New York harbor are to be immediately connected by submarine cables, and similar arrangements are planned for other harbors. That this has not yet been done is almost as foolish an omission as if the defenses had been provided with cannon and no powder. The usefulness of such fortifications as those about New York harbor depends largely, in an emergency, upon their proper coördination, and this can only be accomplished through their direction from one place by an officer in communication with all of them. It is to be hoped that no time will be lost in providing our forts with this absolutely indispensable adjunct.

But the cable laying should not stop with telegraph and telephone circuits. Electricity is already used to a certain extent in harbor-defense batteries for lighting and motive power, and might be used to a much greater extent. It is now ordinarily generated on the military reservation by an engine plant, which cannot well fail to be a prominent object, and one likely to attract the fire of an enemy. A shell in the engine or boiler room of such a plant would instantly cripple search lights and motors. Why not, therefore, supplement the signaling circuits with power circuits, similarly constructed of submarine cables, and fed from a place or places sufficiently remote to be out of danger from stray shots? Such an installation could probably be rushed to completion, at New York, in two or three weeks, and the forts at Sandy Hook, the Narrows and other points, supplied with a reliable source of current for handling guns and ammunition and working search lights.

ELECTRIC TRACTION ON CANALS.

A correspondent criticises the plan recently proposed by Prof. S. H. Short to haul the boats on the Erie Canal by means of trolley cars on the towpath, fitted, if necessary, with a rack rail to obtain the considerable tractive effort needed at low speeds in spite of the light weight of the vehicles. The criticism is on the score that if tracks were laid it might be cheaper to abandon the canal and haul the traffic over the tracks. If canal haulage by horse-power is cheaper than rail haulage, as is often claimed, and electric haulage is cheaper than horse traction, this criticism is, of course, groundless, while, on the other hand, with a completely equipped railroad system it would seem as though the expensive canal for buoyantly supporting the loads would be a superfluous addition.

The low freight rates on the Erie Canal are due to the fact that the canal is built and maintained by the State and the traffic has only to pay for the cost of operation of the boats. The relative cost of transporting freight on privately owned canals and railroads is too well indicated by the fact that railroads are built and canals are not. The canal, of course, has an advantage where it connects at one or more points with bodies of water on which the traffic can be continued with no interest charge on first cost and no maintenance expenses. In this case the right of way for part of the route is free and the cost of construction is nil.

At several times in the past efforts have been made by private interests to construct railway tracks along the Erie Canal for the ostensible purpose of drawing canal boats by steam locomotives. All such attempts have been frustrated by the popular suspicion, undoubtedly well grounded, that the promoters contemplated the establishment of a railroad on a free and already graded right of way. The same objection will naturally apply to the new plan unless it is undertaken by the Commonwealth.

SHORT CIRCUITS.

The short circuit of a continuous current machine, especially one of large dimensions, is an accident to be greatly dreaded. If the machine is shunt wound and self-excited, the establishment of an absolute short circuit across the terminals immediately removes the pressure from the field windings and the field rapidly dies down, so that a continued short circuit automatically kills the field of the machine and prevents further damage after a brief interval. With a separately excited machine, however, the field exciting force remains constant, and with a compound-wound machine the series field maintains the excitation even if the current in the shunt field dies out. The abnormal armature distortion throws the plane of commutation far from its ordinary position and, combined with the heavy current flowing, causes frightful flashing and burning of the commutator, sometimes, especially in high-voltage machines, holding a continued ring of fire around the whole cylinder.

With belted machines the torque developed exerts such a powerful braking tendency that the armature is slowed right down and the belt either slips and slides or is thrown off. With direct-coupled machines the extent of the disastrous effects depends largely on the energy stored up in the flywheel. With no flywheel whatever the energy stored in the moving parts would amount to very little and would have no serious heating effect on the armature, and the only other source of power and consequently of heat is the action of the steam on the pistons, which would, of course, run at such times at a very low speed, although with maximum cut-off. This power would not be sufficient to injure the ordinary armature in the brief time that might elapse before the circuits could be opened by an attendant, or before all the machinery could be shut down. With heavy flywheels running at a high peripheral velocity, there is an enormous amount of stored energy, which on short circuit and the consequent slowing up of the parts proceeds to develop itself as heat in the armature and commutator of the dynamo. If the circuit is not promptly opened these parts soon attain a dangerous temperature and the machine is burned out.

Alternating current generators have a remarkable peculiarity by which these disastrous results are entirely avoided. In the first place, there is no commutator to be injured by extra heavy currents and short-circuited coils in an active field. On dead short circuit, assuming separate excitation, the magnitude and phase relation of the current depend solely on the properties of the armature windings, and as these—especially in ironclad armatures—have an inductance quite high compared with their ohmic resistance, the current lags greatly.

This lagging current, so to speak, is carried along by the rotation of the armature, so that instead of tending to simply distort the field as does an energy current, it flows in the coils at a time when they are immediately under the pole pieces and in such a direction as to demagnetize the poles. Thus, the whole field magnetization is in most alternators easily killed with a current not much greater than the rated load of the machine, a current which the machine would perhaps easily generate at full voltage with somewhat greater field excitation and a non-inductive load to hold the current from lagging.

Thus an alternator built for a normal load of 1000 amperes at 1000 volts will, if the external resistance is diminished to nothing, generate perhaps 2000 amperes at but a few volts, and the surprising result is obtained that as the current increases on an alternator much above rated load, the power indicated by the engine begins to fall off until on dead short circuit the engine is running almost free.

Lowering Transformers for Niagara Power.

BY J. S. PECK.

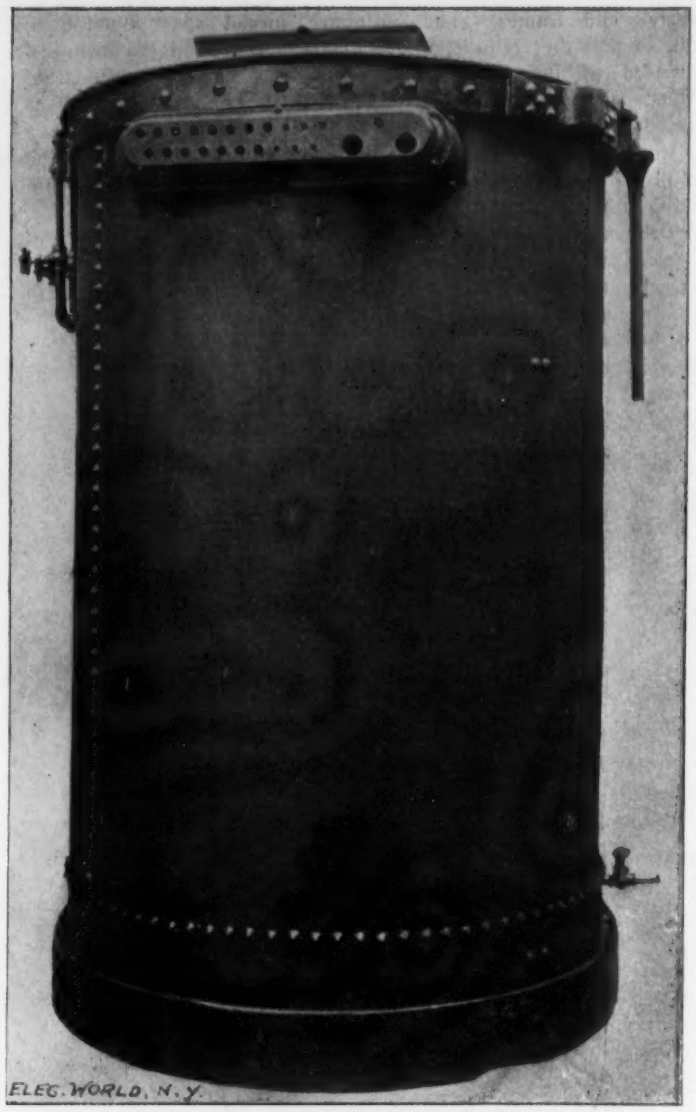
IN the transmission of power by the electric current the employment of larger units and of higher E. M. Fs., while constantly extending the distance to which power may be economically transmitted, is continually bringing up new problems for solution by the electrical engineer.

The method of regulation employed in connection with the large transformers recently furnished the Cataract Power & Conduit Company, of Buffalo, New York, shows the solution of a new problem in power transmission work. These transformers were manufactured by the Westinghouse Electric & Manufacturing Company and are to be used for reducing the high-potential currents of the Niagara-Buffalo transmission circuit to currents of suitable potential for local distribution about Buffalo.

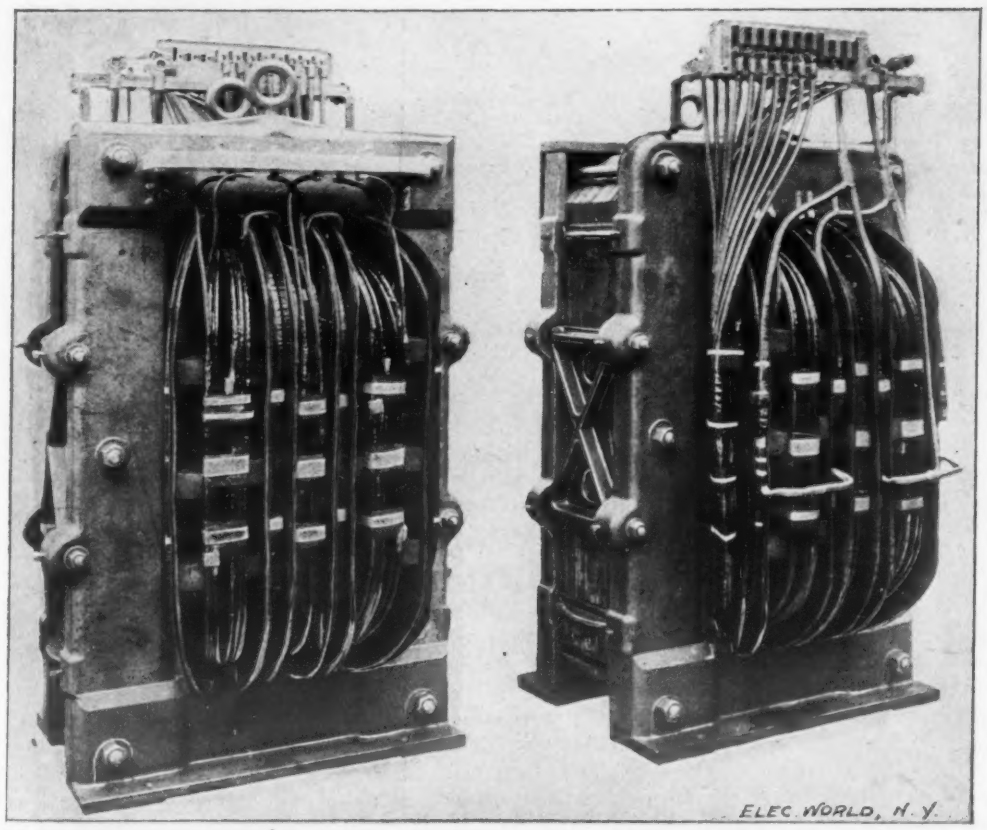
Aside from the novel method of regulation employed, these machines are of interest as representing the latest practice in the design of large oil transformers, on account of their large capacity and of the high potential for which they are wound, and on account of the remarkably high efficiency attained in them. Four transformers have been furnished; three are for actual service and the fourth is held in reserve in case of accident to one of the others.

Each transformer has a capacity of 850 kilowatts. Three are connected together in a group, giving an aggregate capacity of 2550 kilowatts, the greatest output ever obtained from a single group of transformers. The star connection is used on the primaries, the delta connection on the secondaries. The line voltage is now approximately 11,000, but will eventually be increased to 22,000. Since the star connection is used the voltage on the primary of each transformer will be 6350 for 11,000 volts on the line and double this when the line voltage is doubled. The secondary of each transformer is wound for approximately 2200 volts, and as the delta connection is used, 2200 is the voltage across the secondary circuits.

In addition to the main transformers, six 75-kw series transformers and three regulating dials were furnished, also a switchboard and switchboard apparatus.



850-KW TRANSFORMER COMPLETE.



FRAME, CORE AND WINDINGS OF 850-KW TRANSFORMERS.

All the transformers for this installation are oil insulated, i. e., they are immersed in an oil having high insulating qualities. The 75-kw transformers, one of which is shown in the initial, are of the self-cooling type which has been adopted by the Westinghouse Company for all their transformers not exceeding 500-kw capacity, while the large transformers are of the water-cooled type, the standard form for transformers exceeding 500-kw capacity.

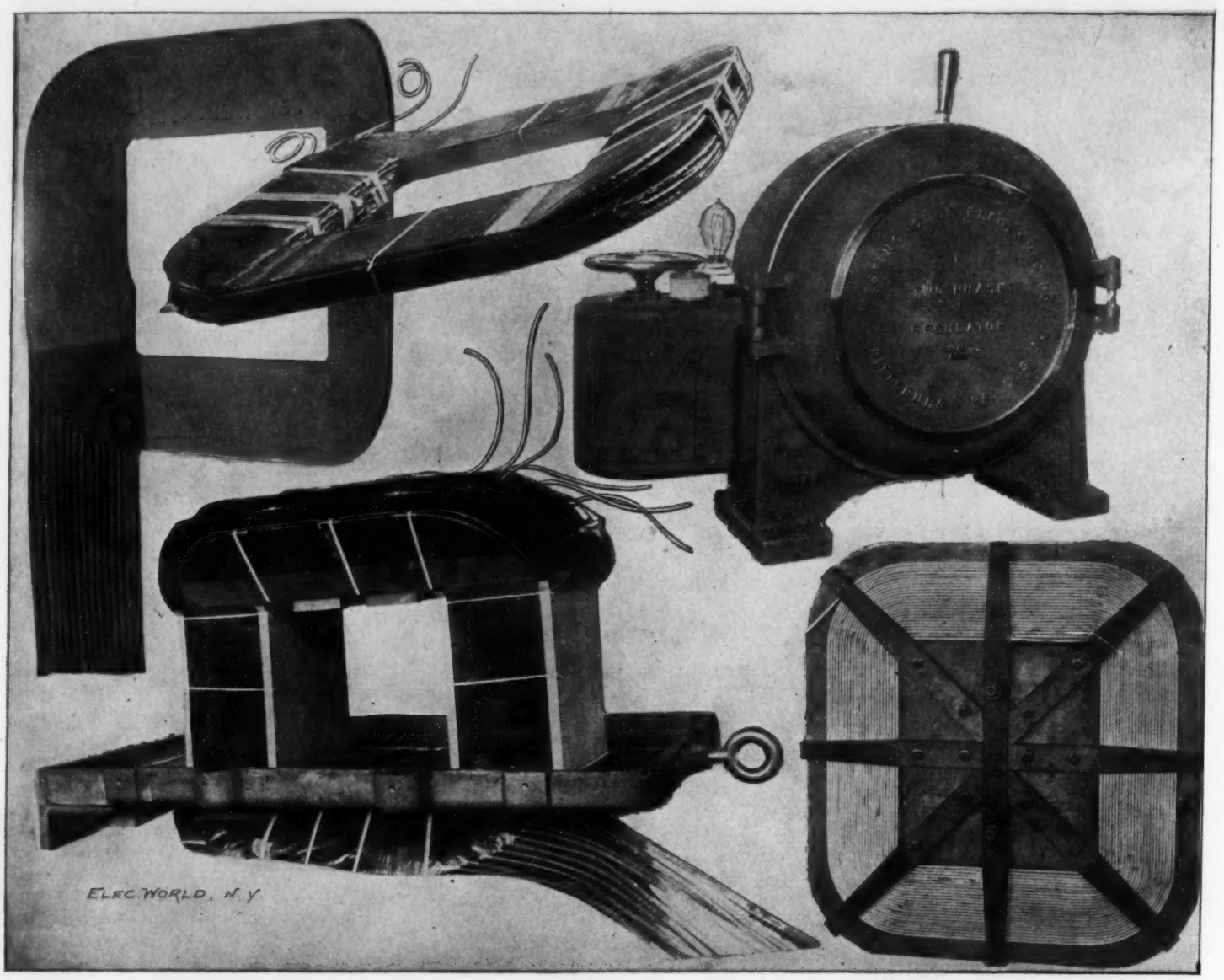
The general appearance of the complete 850-kw transformer is clearly shown in one of the illustrations. The outer casing which contains the oil is of heavy boiler iron, and is mounted on a cast-iron base plate. The cover is also of cast iron and contains two large manholes, so arranged that the terminals may be easily examined without removing the cover. Another cut shows two of the transformers with cases removed. The distinctive features of the Westinghouse transformers are readily recognized. The winding is made of a number of deep, thin coils, the primary and secondary being interleaved to reduce magnetic leakage. The iron is short and is held together by

massive end frames. The coils are spread apart outside the iron, so that the cooling surface exposed to the oil is enormously increased without the loss of valuable space inside the transformer. The surface of iron exposed to the oil is also greatly increased by spacing strips, which are built in at regular intervals as the iron is set in position about the coils. Other illustrations show completed coils and a coil in position on the mould as it is wound on the lathe.

In the manufacture of a transformer of this kind it is not only necessary that the electrical and mechanical design be accurately worked out, but every detail of the method of insulating, even to the space occupied by a single turn of twine, must be carefully looked after in order that the many different parts may fit together accurately when they are assembled. From the photographs some idea

sheet iron, supported in a strong angle iron frame work. The sheet iron is buckled into a great number of flutes or corrugations, which increase enormously the surface exposed to the air. The heat generated in the transformer is conveyed by the oil to the case, through which it is transmitted into the air. The transformer is thus self-cooling and after being once installed requires absolutely no attention.

In the contract for these transformers it was specified that the group of transformers should deliver their rated output to three separate secondary circuits at any voltage between 2200 and 2300 when the primaries were supplied with any voltage between 9500 and 11,000 or between 21,000 and 23,000. In changing from a line voltage of approximately 10,000 to approximately double this pressure the transformers will be shut down and the connections of the primary



Auxiliary Coil. Main Coil in Insulating Wrapping. Windings Assembled.

Regulating Dial for Boosters. Primary Coil on Mould.

may be obtained of the method of insulation. Each coil is treated and insulated separately, then they are assembled with sheets of solid insulating material between adjacent coils.

Just inside the case of each transformer, extending down about one-half the depth of the case, are three coils of heavy iron pipe through which the water for cooling is circulated. The three coils are connected in multiple, each being provided with a valve, so that the flow through each coil may be adjusted to any desirable amount. This system of cooling has been found to give most excellent results. The proper adjustment of the water supply having once been made, the transformer will run indefinitely with practically no attention.

The series transformers, used for regulating the secondary voltage, have the same general characteristics as the large ones, the principal difference being in the form of case used and consequently in the method of cooling. In these transformers the case is of heavy

coils changed from multiple to series. But for any variation within the limits given, the secondary E. M. F. is to be held constant or varied as desired, without even momentary interruption to the service.

Several different methods have heretofore been employed for varying the ratio between primary and secondary E. M. F. The two most common methods are: First, to bring out loops from the primary winding and change the line connection from one point to another, thus changing the number of primary turns; second, to bring out in the same manner loops from secondary winding, making a similar change in connections.

The difficulty in constructing a regulator which will be perfectly safe for use in a 10,000 or 20,000-volt circuit is so great as to preclude the use of the first method of regulation in connection with these transformers, while were the second method employed the excessive

currents which would have to be handled would make the construction of a regulator both difficult and costly, and its continuous action would be uncertain. This method was also discarded. Other methods of regulation which have been employed are all, for various reasons, unsuited for these transformers. The method which was finally worked out is shown, as applied to a single transformer, in Fig. 1. In each transformer there is an auxiliary coil wound to deliver approximately 750 volts and a maximum current of 300 amperes. Loops are brought out from this coil at regular intervals, and are connected to a regulator dial. A 75-kw series converter, which is wound for approximately 750 to 240 volts, has its secondary coils in series with the secondary coils of the main transformer, while its primary is connected to the regulator. The regulator is so arranged that any loops from the auxiliary coil may be connected to the

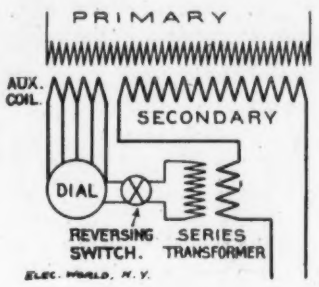


FIG. 1.

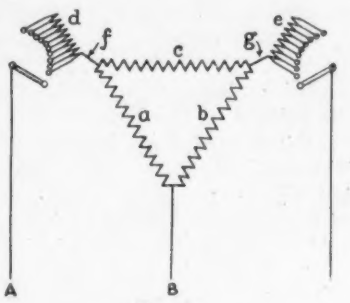


FIG. 2.

primary of the series transformer so that the secondary will deliver from 0 to 240 volts, depending on the loops connected to the primary. There is a reversing switch in the primary circuit of the series transformer, so that its secondary voltage may be added to or subtracted from the voltage delivered by the secondary of the main transformer. By this method of regulation the highest E. M. F. upon the regulator is 750 volts, while the maximum current which has to be handled is 100 amperes.

Another novel feature in the regulation of these transformers is that although three-phase currents are delivered at the desired E. M. F., regulators on two phases and only two series transformers are used in each three-phase circuit. The method of accomplishing this result is shown in Fig. 2. *a*, *b* and *c* are the secondary coils of the three transformers with delta connection; *d* and *e* are auxiliary coils in transformers *a* and *b*. Loops are brought out from the auxiliary

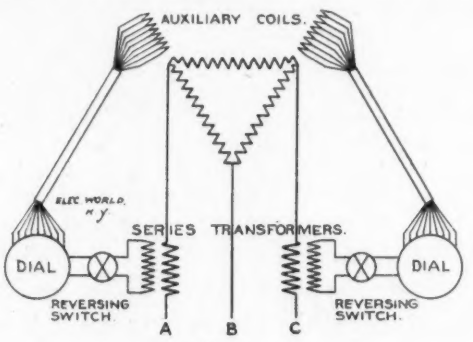


FIG. 3.

coils, which are connected at *f* and *g* as shown. *A*, *B* and *C* are the three secondary line wires. From the diagram it is evident that if the line *A* be moved along *d* away from *f*, the voltage from *A* to *B* will increase at a certain rate, while that from *A* to *C* will increase at a less rate. If the line *C* be moved along *e* away from *g*, a similar change will take place in the E. M. Fs. from *C* to *B* and from *C* to *A*. It is thus evident that if both *A* and *C* be moved simultaneously along *d* and *e* respectively and at the same rate, the E. M. Fs. from *A* to *B*, *B* to *C* and *A* to *C* will vary simultaneously and will remain always equal to each other.

The method of applying this principle to three transformers is shown in Fig. 3. Here, the general arrangement of the coils in the transformer is the same as before; the lines *A* and *C* are, however, not connected directly to the auxiliary coils, but are in series with the secondary coils of two series transformers. The terminals from the auxiliary coils are carried to two regulating dials which are arranged as stated in connection with Fig. 1. The auxiliary coil in the third transformer is not shown, as it is left idle, it being put in simply to make the four transformers similar and interchangeable.

The two dials indicated in Fig. 3 are combined in one regulator, an illustration of the exterior of which is shown. The handle seen at the top of the regulator operates on the forward stroke the dial in one phase, and on the backward stroke the dial in the other phase, so that the voltage is alternately changed in the two phases. The steps are less than one-half of 1 per cent. To the left of the regulator is shown the wheel operating the switch for reversing the primaries of the series transformer. An interlocking device prevents this reversal except when contact arms are in proper position, which position is indicated by the lighting of a lamp. The position of this lamp may be seen in the photograph.

The handle is made to operate the dial arm in one direction or the other by pulling it out slightly and twisting it through approximately 90°. This movement changes the positions of the pawls so that the

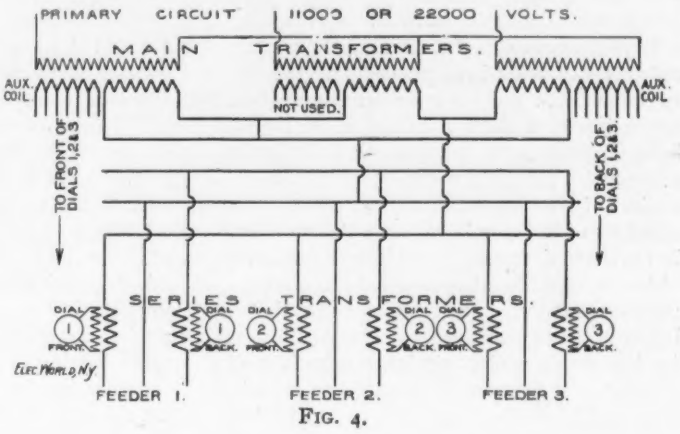


FIG. 4.

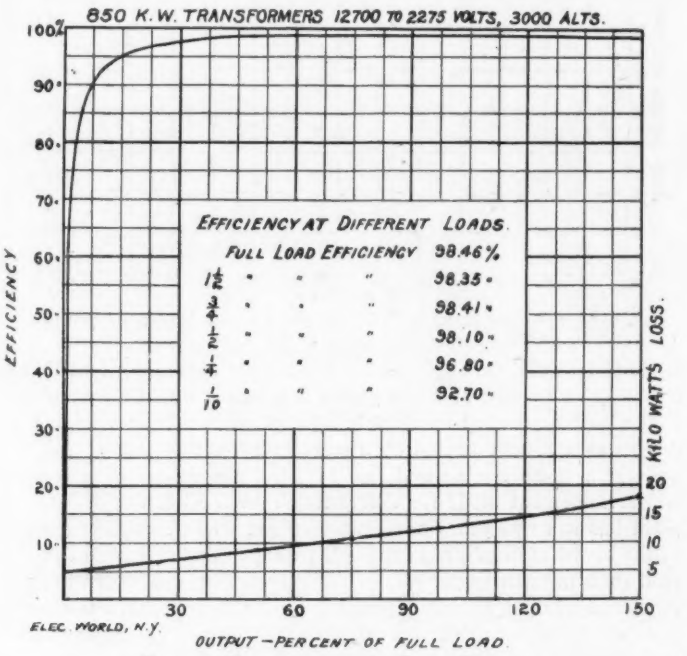


FIG. 5—EFFICIENCY AND LOSS CURVES.

back and forth oscillations of the handle move the two contact arms intermittently and alternately in opposite directions. A pointer on the handle and a name-plate on the case indicate the proper position for the twisting of the handle. No preventive coils are used in these regulators and the segments are never bridged by the sliding contacts. To avoid arcing and prevent any continued opening of the circuit the contact arm is driven by a spiral spring which is put in tension by the movement of the handle. As the latter reaches its extreme position it releases a trip which allows the contact arm to jump quickly under the spring tension from one contact to the next. A reverse stroke of the handle operates similarly on the arm in the other phase.

Fig. 4 shows a complete diagram of all the transformer and regulator connections for three sets of three-phase feeders. It will be seen from this diagram that any feeder circuit may be regulated independently of the other two.

The efficiency curve of one of the transformers is shown in Fig. 5. This curve was obtained from actual measurements on the transformer.

Complete temperature tests under various conditions were made on all the transformers. It was found that starting with the transformers at the temperature of the air they would carry full load for six hours without cooling water and without rising to a dangerous temperature. One gallon of water per minute was found to be sufficient to keep the temperature down to 40° C. above that of the surrounding air. Within certain limits an increase in the amount of water above one gallon per minute produced an approximately proportioned decrease in temperature.

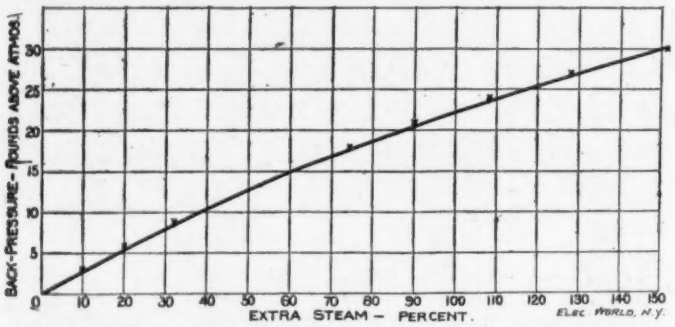
The weight of a transformer complete is approximately 19,000 pounds. The diameter of the case is 5 feet 4 inches, and the total height is 9 feet 1 inch.

The Economical Use of Exhaust Steam.

BY A. H. PERKINS.

Experiences as to the economy or want of economy in the use of exhaust steam for heating, drying, etc., are as varied as the people who have had the experiences. Some find that the heat from the steam has cost them nothing: some that the power developed has been without extra expense for coal; others find some saving, and some find a loss in the employment of this waste product. This is a subject of vital importance to all power users, for on a correct understanding of it depends not only the most economical design of plant, but perhaps the possible success of the enterprise.

As an instance of the varied experiences derived, the author remembers reading in a technical paper that in a manufacturing establishment using water power normally, but having a relay steam plant for low water, and using large quantities of steam for heating, drying, etc., the firemen were unable to tell when the engines were running and when they were not, owing to the fact that the engines exhausted into the heating mains. Under such conditions as this the economy of the use of water power is rather a doubtful quantity.



VARIATIONS OF STEAM CONSUMPTION WITH BACK PRESSURE.

The writer installed an electric light plant in a little village where there was a college heated by a steam plant consisting of two 50-hp boilers; a 50-hp engine and two 17½-kw generators were installed, and arrangement made for exhausting into the heating mains. The plant has run two years now, summer and winter, and the president of the board of directors of the college states that although they have paid their fireman $5 per month more than they did before the lighting plant was put in, the expense for fireman and coal has been less per year since the plant was installed than it was on the average for the previous ten years, when the plant was used for heat only. Of course the *saving* in coal was due to some minor changes in the heating system itself, but the fact is clearly shown that their power for light is costing them practically nothing for extra coal.

On the other hand, Dr. Louis Bell, in THE ELECTRICAL WORLD of February 26, enters an emphatic protest against the use of exhaust for drying in paper mills. This is also brought out in connection with the same industry in a report of tests, etc., by Mr. Frank W. Schillitt.* As this serves excellently well to illustrate what I have to say in this regard, I shall give the facts in this case quite fully and refer to them later. In this case Mr. Schillitt found a 13-inch x 21-inch Buckeye engine, running 175 r. p. m., driving the mill machinery and exhausting into thirteen driers. There were twenty-seven of these driers, the remaining fourteen being heated with live steam direct from the boilers. For running the engine and heating the thirteen driers when the engine was exhausting into them 2868 pounds of water per hour were required. For running the engine exhausting free and heating the driers with live steam 2745 pounds per hour were required, showing a saving in favor of direct steam for drying of 123 pounds per hour. The back pressure used was 23 pounds.

* See *Power*, June, 1897.

What then are the rules governing the use of exhaust steam? When does the loss from its use become equal to the gain to be derived from such use?

Assume first the same boiler pressure applied to the engine when exhausting into the heating system as when exhausting into the air. How much more steam will the engine use to produce the same number of horse-power in the former case than in the latter? The cost of the exhaust heat obtained is this excess. The accompanying curve shows the extra steam consumption in per cent. as the back pressure increases, based on a 14 x 36 engine running 85 r. p. m., producing 100 horse-power continuously, and expanding according to Mariotte's law. From this it can be readily seen when it is economical to use exhaust steam or when it would be better to heat with live steam. If it is necessary to maintain 6 pounds pressure in the exhaust main it will not pay to use the exhaust unless the amount of exhaust so used exceeds 20 per cent. of the amount of steam normally used by the engine. If only 3 pounds is necessary in the exhaust main, then more than 10 per cent. of the exhaust should be condensed for heating purposes if any gain is to result from the use of the exhaust. (This supposes that the excess of steam from the exhaust not needed for heat is blown away at the higher pressure). This applies to non-condensing engines, either simple or compound; but with the compound engine back pressure increases the liability of expanding below the back pressure line.

If the boiler pressure can be increased the available limits are widened, owing to the smaller amounts of steam necessary, due to higher ratios of expansion.

If the system of piping is such that an air pump applied to the drip will produce a proper circulation of the steam, and if the temperature of exhaust steam under the degree of vacuum necessary to produce that circulation is high enough to accomplish the heating purpose in hand, then it will pay to use exhaust steam whenever the amount of steam needed for heating purposes costs more than the running expense of the air pump.

When there are facilities for condensing, the per cent. that can be saved by condensing must be added to the per cent. shown by the curve to produce the true cost of the exhaust, except when the air pump can be applied to the heating system as noted above, and then the curve extended back to absolute zero of pressure applies.

Let us now apply this law to the case of the paper mill noted above. Here we assume that 23 pounds back pressure were necessary to produce the required temperature for the driers. Referring to the curve we find that there must be about as much steam needed for drying purposes as for running the engine when exhausting free; *i. e.*, the engine uses 100 per cent. more steam under 23 pounds back pressure than when exhausting free. The thirteen driers, however, required somewhat less steam than the engine used running without back pressure. Hence we should expect a saving from the use of live steam. The steam required for heating was, however, nearly equal to that required by the engine for its work, hence we should have but small gain by changing to live steam, as was found. If the conditions, however, are such that exhaust steam can be used in both of the sets of driers, the saving due to using exhaust steam in both of them will be nearly equal to the amount of live steam necessary for one set of driers.

The Decline of the Suburban Steam Railroad.

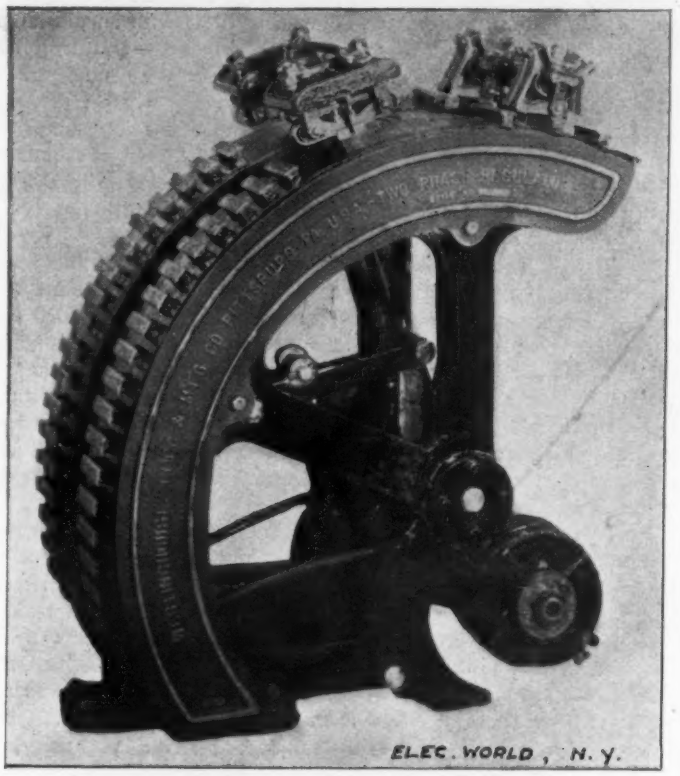
According to the report of the Board of Railroad Commissioners of Massachusetts for the year 1897, the total number of railroad passengers to and from the city of Boston has diminished 12.2 per cent. between 1893 and 1897. On the other hand, the number of street railway passengers on the Boston city and suburban lines has increased 31.2 per cent. in the same time.

The number of passengers on the steam railroad is not classified into through and suburban service, but as it is more than likely that the number of through passengers has increased, the suburban traffic must have fallen off by about 25 per cent., the same percentage being a safe estimate for the increase of the suburban part of the street railway traffic. The total number of passengers on the street railway lines of Boston and the suburbs in 1897 was over 200,000,000. With regard to the cause of this change, the report may be quoted as follows: "This shifting in the current of the traffic in question is not to be attributed in the main to anything that the railroad companies have done or have failed to do. It is the result of well understood changes in the condition of such transportation, for which the railroad companies are not responsible and which they are practically unable to control."

An Isolated Plant in Railroad Shops.

The new locomotive and car shops of the Boston and Maine Railroad, at Concord, N. H., have been fitted with a complete isolated plant equipped with alternating-multiphase apparatus, a rather unusual feature for isolated plant work where the distribution is over moderate distances and there is a considerable motor load, part of which must start under heavy torque. The shops, with the accompanying tracks, cover an area of twenty-six acres and are intended to care for about 300 locomotives, beside repairing a large number of freight and passenger cars.

The power plant is centrally situated, the maximum distance of transmission in the yards being about 800 feet. The equipment comprises a battery of three locomotive-type boilers, two tandem compound Fitchburg 200-hp engines and one 100-hp standard Westinghouse engine. The Fitchburg engines are belted to Westinghouse two-phase 150-kw generators of the internal revolving armature type, with rectifiers and compound field windings. The Westinghouse engine is belted to two arc machines. The two-phase alternators feed lighting circuits which are wired for about 450 incandescent lamps,



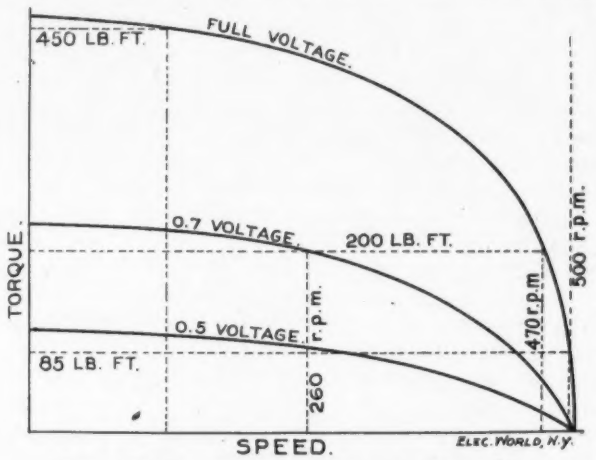
CONTROLLER FOR TWO-PHASE CRANE MOTOR.

and also feed motor circuits for various parts of the shops. The generators run at a speed of 514 r. p. m., giving 440 volts direct, with a frequency of about 60 cycles per second. This voltage is stepped up to 1000 and again reduced to 104 for the lighting of some distant points, the pressure for the lamps in the yards themselves being stepped down directly from 440 volts, and the motors being supplied at the latter voltage. All the motors are of the polyphase induction style, known as the Westinghouse "Type C," which have been illustrated in THE ELECTRICAL WORLD in the description of the Great Northern Elevator, in the issue of February 12, 1898. These motors have the primary winding on an external fixed ring and the short-circuited secondary on an internal revolving rotor.

There are already installed one 30-hp, three 20-hp, one 15-hp and one 5-hp motors, beside the six motors described below for running the cranes and one for the transfer table.

The locomotive shops are fitted with two electric cranes with a carrying capacity of 30 tons each, supplied by William Sellers & Co., Philadelphia. The cranes run the length of the shop on one and the same pair of rails mounted on supports independent of the roof columns, 24 feet above the shop floor, the span between the rails and consequently the length of the crane bridges being over 66 feet. The cranes are each fitted with three motors of the type mentioned above, one for traversing the whole crane, one for moving the trolley along the length of the crane and the other for the lifting of the load. The crane traveling speed is about 200 feet per minute, while the cross motion of the trolley is about one-half that, and full load may be lifted at 12 feet per minute, or by means of a back gear arrangement smaller loads may be lifted four times as rapidly.

The motors are controlled entirely by variations in the primary circuits, the secondary being short-circuited within the rotor at all times, with a resistance sufficient, however, to give a torque curve with its maximum point at standstill. The control is effected by means of the quadrant-shaped regulator, shown in the illustration, the two rows of segments being respectively connected with two auto-converters, one in each phase, this term signifying transformers with single continuous coils tapped out at various points to the contacts. Obviously different voltages can be obtained by connecting the external circuit between one terminal and the different contacts, and currents so drawn cause the coils to act as alternating current motor generators or step-down transformers. The torque given to the motor shaft at any speed is approximately proportional (as shown in the diagram given herewith) to the square of the voltage supply, so that when a motor is started from standstill the torque runs up as the arm of the regulator travels over the contacts, being 1 per cent. of full voltage torque on 10 per cent. of the full voltage, one-quarter of full torque on one-half full voltage, and so on. When the torque rises to a point sufficient to turn the load the motor starts up and the increasing speed chokes back the current and maintains the torque at such a point that the load is balanced. It is thus possible with this method of control and type of controller to start the motor smoothly under anything less than full load and to control its speed under any load between standstill and the full speed which is obtainable at that load, although fine adjustments of low speeds are difficult. Of course, with the full maximum load of the motor and this form of torque curve, the speed will be very low and the less the load the higher the speed obtainable, the motor running up almost to synchronism on no load. Thus, with the dimensions assumed in



SPEED-TORQUE CURVES AT SEVERAL VOLTAGES.

the accompanying figure, a torque of 200-pound feet gives a speed of 470 turns per minute with full voltage, or but 260 turns at 0.7 of full voltage, and will not start even with half voltage, while a load requiring a torque of 450 pound feet can only be turned over at a slow speed at full voltage and will not start at all on lower voltages. On the other hand, a small load of 85 pound feet, as indicated, can be turned up almost to synchronism, and at any desired speed below that by proportionally lowering the voltage. The behavior of the combination is, therefore, quite similar to that of series direct-current motors, the most successful machine in commercial use for work at varying speeds and on variable loads. The efficiency of the induction motor, however, with high resistance in the secondaries suited to give this result, is reduced by the losses in this secondary resistance, which also tend to heat up the rotating part of the motor. The almost ideal simplicity of the machine and its absolute freedom from bare copper make it of value in spite of this.

Electric Cabs in Paris.

La Compagnie Générale des Petites Voitures de Paris has decided to construct 250 electric fiacres. These will be of the same type as those already in use in Paris, having a removable accumulator box. The equipment will comprise a 2.5-hp motor of English design, the patent rights of which are owned by the company. The type of accumulator to be used has not as yet been decided.

Station Photometry.

BY BUCKNER SPEED.

The following explicit and detailed directions for the construction and operation of a central station photometer department may be of value to electric lighting engineers who wish to take more care as to the lamps they are using, but do not know just how to go at it:

There should be at the station in the testing room a photometer in the form of a closed wooden box, 8 feet long by 16 inches square, painted dull black inside and out. This photometer box should be provided with baffle diaphragms as described below.

At one end of this box should be placed a standardized 16-cp lamp, at the other end the lamp to be tested, and between these lamps a photometer rail carrying the screen carriage. The screen should be an ordinary reversing Bunsen spot, viewed on both sides simultaneously by means of inclined mirrors.

Carried by the screen carriage there should be a hood, looking into the mirrors, and also projecting through the face of the photometer box and carrying a sliding cover which, moving with the hood, should cover the slot in the front of the box through which the throat of the hood slides.

By this means the observation of the spot and the reading of the bar may be accomplished without admitting light to the box.

The sliding screen carriage, hood and sliding cover should be rigidly connected, and attached also to a pointer traversing a scale fixed on the front of the photometer box.

STANDARD LAMPS.

Greater confidence can be placed in the results obtained by the use of lamps standardized with care on a plain candle bar photometer, than by the use of so-called standard lamps purchased on the market.

Buy three packages of one dozen English standard sperm candles from three supply houses in different cities and number and label each candle, also enter in record book the number and maker or furnisher of each dozen candles. Select from each package the best six average candles, choosing well centred wicks (at both ends) and rejecting those which caliper furthest from the mean in diameter, also caliper size of wick, note and record color of sperm and reject those which are not the same color as the others in the same package.

Light these selected eighteen candles in a still room and let them burn until the cups have reached the full diameter of the candle. Blow them out and empty the cups of melted sperm formed around the wicks. Trim the rims of the cups flat to the wick, trim the wicks square off, leaving them one-half-inch long from the flattened cups. Light the candles again and let them burn down about one-half inch of sperm, then select the best three out of each original lot, judging by medium height of flame and good behavior of wicks, etc. This will give nine representative candles; the mean of the light of the nine is to be taken as the true candle power. They are the primary standards.

These nine candles are to be burned one by one on a regular or improvised bar photometer, the candles being mounted on a weighing balance to correct for rate of burning by grains of sperm consumed per minute. The candles are not to be burned to butts shorter than 1½ inches in length.

To insure concordant results in the burning, trim the cup flat, trim the wick half an inch long, turn the flat side of the wick perpendicular to the bar, light the candle and let it burn until flame is 1¼ inches high, bring the weighing balance beam to zero and start the stop watch when the pointer of the balance crosses the zero line. Take off ten grains weight at once and catch the first photometer reading at the first thirty seconds and on each half (not even) minute reading thereafter. This will get in five readings one minute apart and leave about half a minute for the catching of the sperm weight at the end of the five minutes. When the balance pointer again crosses zero, stop the stop watch and record the time of the burning of the ten grains.

If the room is large and perfectly dark and the walls black and all white substances guarded against reflecting light toward the screen, the candle power of an incandescent lamp at the other end of the photometer bar can be determined with reasonable accuracy.

Nine standard candles having been selected for the primary standard, as detailed above, from them by direct comparison are to be made the secondary or working standard incandescent lamps for use in the station photometer.

From a barrel of 250 high-grade lamps carefully choose twenty-five lamps, avoiding any handling of the glass, and manipulating them by the brass bases only. These twenty-five lamps must conform to the following requirements:

1. Efficiency not higher than 3.6 watts per candle-power (take the maker's word as to this).
2. Lamps to have Edison screw bases with porcelain filling, bulbs to be of uniform size and shape and of good workmanship.
3. Filament to set true and central in bulb and to lie in a flat plane when cold, forming a single unanchored U.
4. Filaments to remain flat and plane when current is turned on and not to curl or twist any when lighted and turned out.

In handling the lamps in the socket for this trial use the tissue paper in which they are packed and do not touch the glass.

Examine these twenty-five again, noting:

1. Faulty or protruding leading in wires or loose bases.
2. Striations in the glass.
3. Kinks in the filament or bright spots in the filament when lighted.
4. Lack of uniformity in the size and position of the filaments in the globes.
5. Undue fluorescence of globes when the current is on.

Probably twenty will stand this inspection. Measure each one of these on the station photometer, comparing them with an old lamp which has burned at least 200 hours and which in general complies with the conditions just noted. Mark and record the candle power of each of the new lamps in terms of the old one which is a temporary selecting standard. Compute the mean of the new lamps in terms of the old lamp and reject any lamps that are very far from the mean value. Number each lamp that passes this test with a lead pencil on the porcelain base and record its value in percentage terms of the old lamp, in a record book.

Put all these lamps (from eighteen to twenty) in a bank of receptacles very heavily wired to prevent drop, and let them burn 100 hours on the station current. After the lamps have been burned 100 hours compare them again with the temporary selecting standard lamp (the old lamp) which has been carefully laid away in the mean time and neither used nor handled. Measure and record the values of the lamps now after their 100 hours of burning, in percentage terms of the old lamp. In this test, include an ammeter in the circuit of the new lamp and also measure the voltage and hold it at the rated voltage of the lamp.

Select the nine lamps from the above lot which are nearest the mean in candle power in terms of the old lamp, rejecting those which have changed most in the 100 hours, also any which have current consumptions far from the mean current of the lot. Make a mark on the globe near the base ferrule, so that the same face of the filament will always be turned toward the photometer screen. Provide separate stout pasteboard boxes for each lamp, the boxes to have hinged tops and to be provided with cotton batting lining and padding. In the top of each box put a copy of the full record of the lamp as taken from the record book.

These nine lamps are now ready for standardizing. They are at their most stable period of life, having in the 100-hour burning flashed off all their initial irregularities, and from the above tests and examinations have proved themselves to be the best of good hardy lamps. When their mean value, determined from the nine primary standard candles is known, then they become the secondary or working standards. Test these nine lamps one by one with a regular standard candle bar photometer, using the nine primary standard candles one by one.

The lamps are to be marked on the porcelain bases in India ink 1 2 3 4 5 6 7 8 9.

Similarly mark the candles A B C D E F G H I.

Using candle A, measure lamp No. 1 with it for five minutes, thereby obtaining five settings of the screen. Average these and correct by the consumption of sperm.

As soon as the five-minute test on lamp No. 1 is made blow out the candle, trim it and get ready for the test of lamp No. 2 on candle A, and in each case let each five-minute burning be a separate test.

On candle A test lamps Nos. 1, 2, 3, 4.
On candle B test lamps Nos. 2, 3, 4, 5.
On candle C test lamps Nos. 3, 4, 5, 6.
On candle D test lamps Nos. 4, 5, 6, 7.
On candle E test lamps Nos. 5, 6, 7, 8.
On candle F test lamps Nos. 6, 7, 8, 9.
On candle G test lamps 7, 8, 9, 1.
On candle H test lamps Nos. 8, 9, 1, 2.

On candle I test lamps Nos. 9, 1, 2, 3.

The exact details of this test should be as follows:

Carefully take lamp No. 1 out of its box without touching the glass and screw it into the adjustable socket in the standard photometer. Turn the marked face toward the photometer screen, set the plane of the filament exactly perpendicular to the axis of the photometer bar and concentric with it, let the axis passing through the centre of the screen (parallel to the axis of the bar) pass through the loop of the filament so that the distance from this axis line to the top turn of the filament is equal to one-third of the height of the filament.

Hold the voltage delivered to the lamp steadily at the voltage marked on the lamp, using a small rheostat for the purpose. Let one observer work the rheostat, record voltage, current and watts, while the other is making the settings.

The first mentioned observer should manage the candles, stop watch, meters and rheostat so that the screen observer need not use his eyes for anything but his own observations. As soon as lamp No. 1 is finished and recorded put it back in its box. Blow out the candle, trim the cup flat and the wick to one-half-inch and start again on lamp No. 2 when the flame has come to length.

It will be seen that the comparison of the nine secondary standard lamps with the nine primary standard candles, with four five-minute sets of observation on each candle, each of the observations consisting of five screen settings, involves 180 settings of the photometer screen. By steady work this can be done in two days without unduly long hours in the photometer room.

To compare these values and get the most probably correct value of the nine secondary standard lamps a simple graphic method will be found the most practicable.

On thin tracing paper lay off and plot a separate diagram for each candle as follows: Draw a base line and four equidistant perpendicular lines and on these to a convenient scale lay off the candle powers of lamps 1, 2, 3, 4, as obtained from candle A; mark this diagram "A." In like manner make diagram "B" show the values of lamps 2, 3, 4, 5, and so on, making in all nine diagrams. Next superpose the corresponding numbers on each sheet over each other as nearly as the three points will fit, keeping the perpendiculars always parallel to each other, and draw a new mean base line through the average of all the base lines of the diagrams. In this way the most probable true value of the lamps will be obtained in terms of the mean of all the candles.

It might be of interest and also serve as a check on the readings to plot the values as corrected on a new curve having nine ordinates, each candle power, as corrected by the above graphic method being laid off. Also plot the comparative values which these lamps gave when they were balanced again by the temporary selecting standard lamp, referred to above as the "old lamp." This is not, however, necessary.

Having now secured nine lamps of more than average excellence and with reliably known candle powers, make copies of the records of each lamp and paste them in the insides of the individual lamp boxes. Three of these lamps should be filed away for reference and not used unless some dispute comes up as to the candle-power standard in use by the station at that date. For instance, if the maker of a lot of rejected barrels of lamps disputes the standard these lamps will be a readily reproducible candle power standard. The remaining six lamps are to be each used fifty hours of actual testing only.

STATION TESTING.

Take the case of a consignment of fifty barrels of lamps warranted by the maker to deliver a specified candle power for a given number of hours of burning, with a variation of voltage not to exceed a specified percentage above that marked on the lamps.

Two lamps should be taken at random from each barrel. A box with compartments, like an egg shipping box, is to be provided and each pair of lamps put in a separate compartment with a card bearing the number of their barrel. These 100 lamps are then to be measured on the station photometer and in the record book are to be placed the serial numbers of the barrels, etc., the candle power of each pair of lamps and the current and watt consumption. With the station photometer all this can be done in two hours at the outside and has been done in much less time.

There should also be provided a heavily wired bank of receptacles laid off to correspond to the compartment box mentioned above, and each of the lamps should be put into its receptacle and burned continuously. This bank of receptacles may be located in the dynamo room, where the attendants can check the voltage at frequent intervals. A rheostat and a recording voltmeter (checked once a week with a standard instrument) should be connected to this bank of receptacles, so that a record of the voltage at which the lamps were burned can be obtained.

On a regular day each week the current should be switched off, and all the lamps run through the station photometer, and this repeated until they are burned out or the contract for life and candle power has been fulfilled. About five weeks will be the duration of the burning.

A full statement may then be made showing the average candle-power, maximum and minimum candle power, and current and watts (total and per candle power) of the lamps from each barrel.

There may accompany this report the diagrams of the voltage from the recording meter, which will also show the duration of the burning and the duration of the intervals during the weekly tests.

No lamps should be used from the barrels under trial until they have been tested fully and the report approved by the buyer of the lamps.

If the average of two lamps is below the required values or if either of them is very much below, then there may be taken from the doubtful barrel another sample of three lamps and the decision upon the barrel may be withheld until they are fully tested. Then if the barrel still falls below the requirements it should be returned to the maker.

The Telectroscope.

The name Telectroscope has been applied by the inventor, Jan Szczepanik, of Austria, to a device which, if the daily papers can be believed, has been practically perfected for the transmission of pictures or scenes to a distance by electrical means. Considerable publicity has been given to these experiments by the daily press, although the details of the machine have apparently been kept secret. According to the accounts given the device is a modification of the well-known selenium cell, the arrangement consisting of a transmitter comprising two very narrow mirrors oscillating in planes normal to each other, in such a way as to reflect the light on the selenium cell from but one point of the scene to be transmitted at any one instant, the oscillations being so combined as to make this point cover the whole projection of the image in a brief time. At the receiving end there are similar mirrors operating synchronously with those of the transmitter and reflecting the light received from a prism oscillated electro-magnetically by the currents received from the transmitter. The difficulties that can be foreseen at once in such an undertaking are the maintenance of the synchronism at the very high speed necessary to cover repeatedly all the points of the receiving screen or field with the one traveling ray of light in a time sufficiently short to deceive the eye on the principle of the continuity of images. The extreme sluggishness of the response of selenium to light would appear to prohibit this action, although if only a photographic record is wanted at the receiving end these difficulties would be reduced. It is claimed, however, that the instrument has been practically successful.

Electric Traction on the Long Island Railroad.

The Long Island Railroad Company, whose scheme for a through electrically operated tunnel service to the business district of New York City, was described in THE ELECTRICAL WORLD of November 20, 1897, has been impatient to immediately obtain electric service and better terminals before the tunnel can be constructed. The railroad has contracted with the receiver of the Brooklyn Elevated Railroad to run a through service from Coney Island over the surface lines of the Long Island Railroad and the Fifth Avenue line of the Brooklyn Elevated Railroad to the Brooklyn Bridge. It will also connect the tracks of the elevated road at the Flatbush Avenue station with the terminal of the main line running to Jamaica, giving through service on this route. Still another line will be equipped running from Jamaica and Rockaway Beach via East New York and the Broadway line of the Brooklyn Elevated Road to the Broadway ferry. President Baldwin, of the Long Island Railroad, states that as soon as these contracts are signed and out of the way the consideration of the electrical equipment of these through routes will be immediately taken up and the work pushed to completion as soon as possible. The tracks of the elevated road will also be extended over the Brooklyn Bridge and over the new bridge now building. The officers of these roads are evidently convinced that electric traction is the only proper method of handling suburban service and are acting accordingly.

The Electric Equipment of the Cruiser "Chitose."

BY G. W. DICKIE.

Hitherto in ships designed and built for the imperial Japanese navy the electric installation has been of very limited capacity, used for lighting purposes in the living spaces only, and from motives of economy the electric light is used only on special occasions, candles and lamps being in regular service most of the time.

In the two vessels now building for the Japanese navy in this country a more complete electric installation is being provided, embracing not only a complete and elaborate system of lighting but also electric power hoists for the ammunition of both the main and secondary batteries.

As the Japanese naval officers are very ambitious to get all the service possible out of every device they adopt on their ships of war, it may be expected that in this application of electric power to the handling of ammunition, the highest efficiency of such a system will soon be developed.

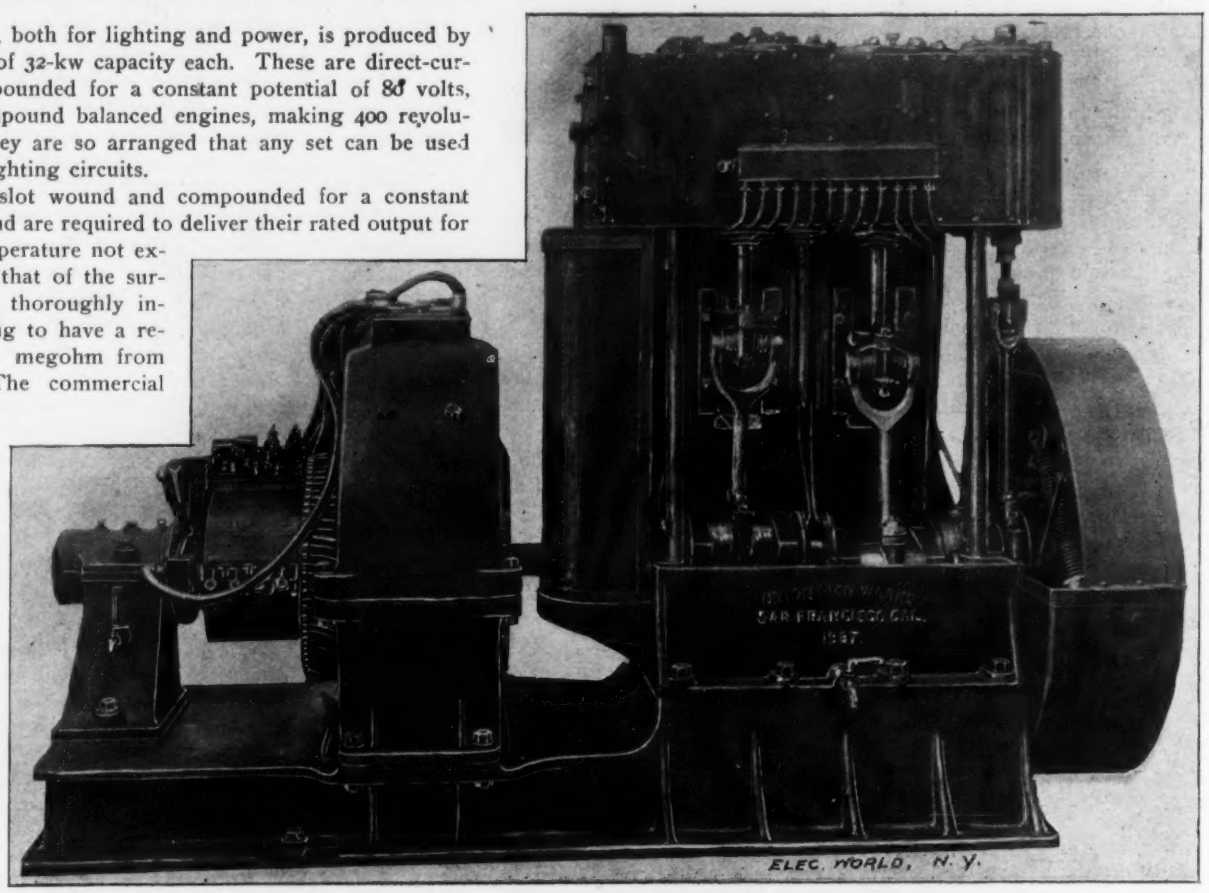
It is my purpose in this article to give a brief description of the electric installation to be fitted on board the second-class, unarmored protected cruiser, "Chitose," now building at the Union Iron Works, San Francisco.

The electric current, both for lighting and power, is produced by three generating sets of 32-kw capacity each. These are direct-current generators, compounded for a constant potential of 80 volts, direct coupled to compound balanced engines, making 400 revolutions per minute. They are so arranged that any set can be used either on motors or lighting circuits.

The armatures are slot wound and compounded for a constant potential of 80 volts, and are required to deliver their rated output for four hours with a temperature not exceeding 60° F. above that of the surrounding atmosphere, thoroughly insulated, and all winding to have a resistance of at least 1 megohm from ground when hot. The commercial efficiency is required to be at least 82 per cent.

The commutator bars of hard copper have a wearing depth of 1½ inches.

As the requirements of these generating sets are the same as those being built for the United States battleship "Wisconsin," which will have eight sets from the same patterns, the first set completed for the "Chitose" was subjected to all the tests required by the United States specifications, so as to determine if any change was necessary before proceeding with the lot required for both ships.



Main Generator and Engine.

These tests were watched for the United States Government by Licutenant Lopez, and for the Japanese Government by Lieutenant Wadagaki, and gave the results shown in the following data:

Heating test, full load, four hours.	Deg. Fahr.
Armature rise in temperature	45
Commutator rise in temperature	65
Fields rise in temperature	49
With 33 1-3 per cent. overload, two hours.	
Armature rise in temperature	69.3
Commutator rise in temperature	98.1
Fields rise in temperature	64.62

The compounding test was made with the engine exhaust on the atmosphere in order to meet the requirements of the United States specification. Regulation tests were also carried out at the same time, no change being made in the position of the brushes on the commutator.

The following table gives the result of this test, which was continuous, lasting about four hours, and was required to range from no load to 100 amperes overload:

Amperes.	Volts.	Revolutions.	Steam.
0	80.25	402	98 pounds.
100	80	402	98 "
156	80	402	98 "
205	80	402	99 "
310	79.9.	400	101 "
360	79.4	4 0	101 "
405	79.2	400	100 "
470	78.75	399	100 "
500	78.25	399	100 "
467	79	399	100 "
417	80	400.5	102 "
350	80.5	401	103 "
300	81	401	104 "
255	81.25	402	104 "
195	81.75	402	103 "
145	81.75	402	102 "
100	82	402	103 "
50	81.875	402	105 "
0	82.5	402	107 "

Sudden changes from full load to no load were made without perceptible racing and with only about 1 per cent. change in speed.

In the efficiency tests, as in the other tests, the steam was taken from the shop boilers through 200 feet of pipe into a receiver near the engines, the condensed steam from the special surface condenser being carefully weighed for each test. No allowance is made for moisture in the steam, as the conditions for the test are supposed to be the same as prevail on board ship in regular service.

EFFICIENCY TESTS.

No. of Test.	Revs	Steam.	Output K. W.	I. H. P.	Com'l Efficiency.	Pounds of Steam Per I. H. P. Hour.	Pounds of Steam Per K. W. Hour.	Vacuum.
1	400	91.5	32.36	50	87%	19.5	30.1	27.33
2	400	92.83	24.3	38.47	84.75	20.5	32.5	26.66
3	400	93.1	16.32	28.44	77	21.9	38.3	26.7

Engines, 8½ inches high pressure, 13½ inches low pressure, and 8 inches stroke. Weight of generating set complete, 9365 pounds.

The wiring installation will consist in general of nine lighting, four searchlight, and two motor circuits, so arranged at the switchboard as to permit of all the circuits working off the three generating sets in multiple, or the lighting circuits on one generator, the search-

lights on another, and the motors on the third, independently. The fixtures to be installed will give outlets for 379 lights.

There will be one rotary transformer for reducing the dynamo potential from 80 to 10 volts, for operating call and signal bell service, and also another for reducing to 6 volts, for firing the guns of the main battery.

There will be ten portable electric fans for the ventilation of spaces not reached by the general ventilation system of the vessel.

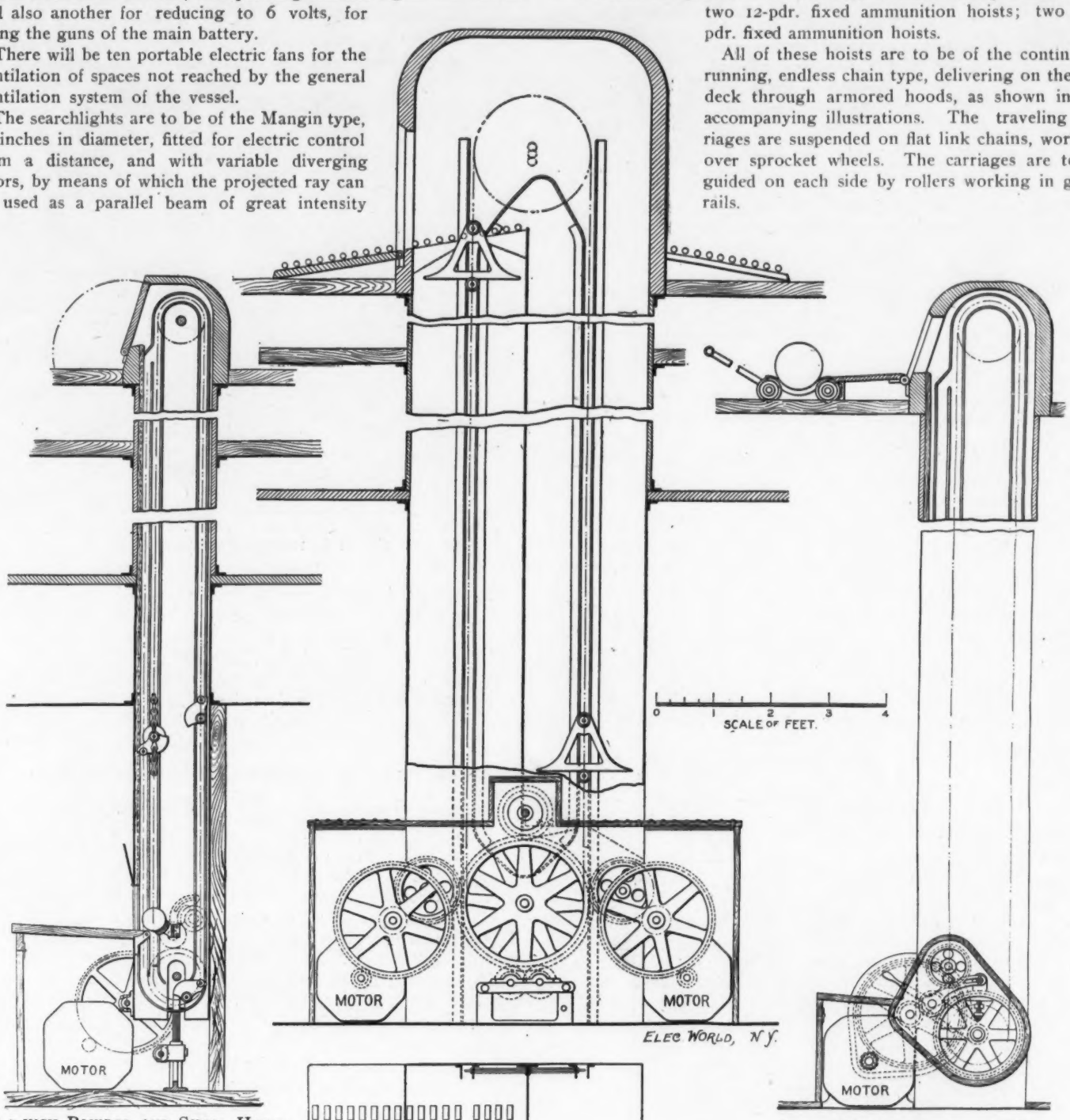
The searchlights are to be of the Mangin type, 24 inches in diameter, fitted for electric control from a distance, and with variable diverging doors, by means of which the projected ray can be used as a parallel beam of great intensity for long distance work, or spread out fan shaped to cover a greater area at a shorter distance.

The entire system will be installed on the two-wire plan, operated at 80 volts. There will be ordinary service circuits and battle circuits, the latter being run under the protected deck. All wires are covered with extra heavy rubber insulation, protected by braid soaked in waterproof compound.

Through boiler and engine compartments the wires will be in iron armored conduit; elsewhere, except the running light circuits and those running up the masts, the wire will be in wood moulding. All connections are made through water-tight junction boxes, and not more than two lights are taken off any one fuse. Stuffing boxes are fitted for the wires at all water-tight bulkheads and decks through which they pass.

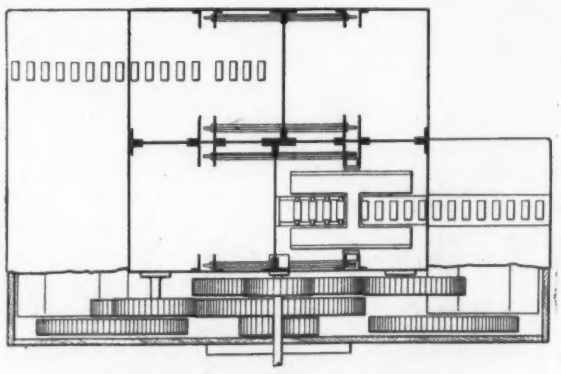
There are to be ten electric ammunition hoists as follows: Two 8-inch shell and powder hoists; four 4.7-inch shell and powder hoists; two 12-pdr. fixed ammunition hoists; two 2½-pdr. fixed ammunition hoists.

All of these hoists are to be of the continuous running, endless chain type, delivering on the gun deck through armored hoods, as shown in the accompanying illustrations. The traveling carriages are suspended on flat link chains, working over sprocket wheels. The carriages are to be guided on each side by rollers working in guide rails.



4.7-INCH POWDER AND SHELL HOIST.

8-INCH POWDER AND SHELL HOIST.



12-PDR. AND 2½-PDR. FIXED AMMUNITION HOISTS.

ELECTRICALLY OPERATED AMMUNITION HOISTS OF CRUISER "CHITOSE."

The 8-inch and 4.7-inch hoists are designed to receive and deliver on the same side, and the 12-pdr. and 2½-pdr. hoists are designed to receive on one side and deliver on the other. All the hoists are faced inside on the working sides with hard wood.

Safety catches are provided and spaced about 6 feet apart, to prevent the shell or powder dropping back, should the chain be broken at any point. The safety catches are provided with relieving gear, for throwing them out of gear to enable ammunition to be lowered from the deck above to the magazines.

The carriages are of bronze, suspended between the chains on steel pins securely attached to the chain links.

The hoists are to be fitted, if necessary, to discharge on the deck below the regular discharge. This arrangement is indicated on the drawings of these hoists. The object of this provision is to be able to serve the guns through ammunition scuttles by hand from below at close quarters, when the upper decks might be swept by the fire of machine guns.

The motors for operating the hoists will all be of the same size and patterns. The illustration is from the first one tested. They are of the four-pole slot-wound armature type, with cross-connected commutators, and designed to operate under a load of 5 horse-power continuously at 520 to 640 revolutions. They are to be set inside casings which protect them and at the same time leave them readily accessible. The contacts on the rheostats are enclosed in a cast iron spark proof shield with the release magnet holding the arm so arranged as to be operated by push buttons at either the main or auxiliary discharge doors in case it should be necessary to stop the hoist from either of these points.

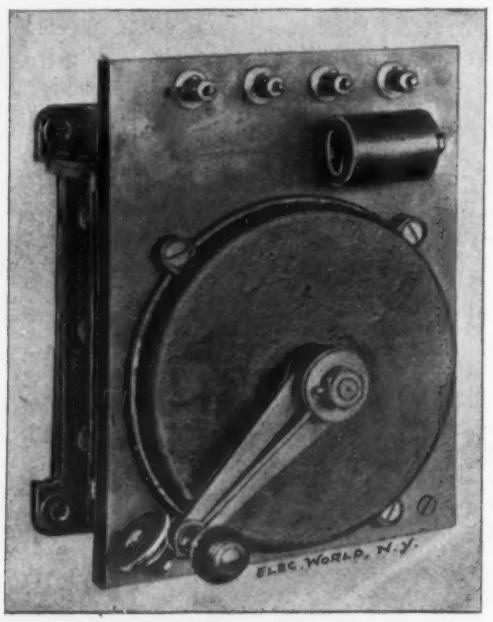
A rheostat in the field circuit permits of a variation of 20 per cent. in the motor speed.

Current for the hoists will be taken from either of two mains, one for the forward hoists and one for the after hoists, leading from the dynamo room through iron armored conduit. These two main feeders will be connected to the main switchboard in such a manner as to be supplied by either dynamo singly or from dynamos operating on lighting circuits.

Each 8-inch hoist is to be capable of delivering three rounds per minute to its respective gun. A round consists of one shell and two powder tanks, each being handled separately.

These hoists will be fitted with six carriages and the chains will have a maximum speed of 100 feet per minute. The armored hood on deck will be partly masked by an extension of the conning tower, the front only being exposed. The interior of the hood will be fitted with a drum mounted on the sprocket wheel shaft as shown, having a recess to receive the charges and so arranged as to close the openings except at the instant of discharging or receiving a charge. This is an important and necessary function, as the principal danger of derangement to this kind of ammunition hoist is from splinters and débris getting into the hoist casing and wrecking the moving parts.

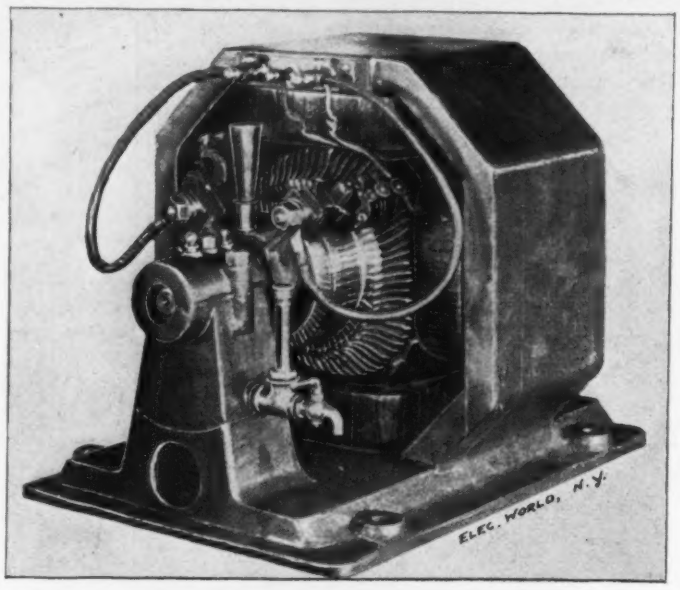
The casing on the gun deck for the after 8-inch hoist accommodates also the 12-pdr. and 2½-pdr. hoists. All doors in the armored hoods are water tight when closed, and are arranged to act when open as discharge or feeding tables for the ammunition.



Controller for Ammunition Hoist Motor.

The 4.7-inch hoists are similar in design to the 8-inch hoists. Each will be capable of delivering twenty shells or twenty powder tanks per minute at full capacity. The forward hoists will have nine carriages and the after hoists eight carriages each. The arrangement of hoists and gears in the handling rooms will be such that either motor or the hand gear can run its own or both hoists, and that either hoist can be used for powder or shell.

The 12-pdr. and 2½-pdr. hoists will be alike in design and as shown on plans. Each will be capable of delivering four boxes of shells and two boxes of powder for 2½-pdr. guns and the same for 12-pdr. guns. Suitable tightening gear has been provided for adjusting the tension of the chains for each hoist.



Motor Driving Ammunition Hoist.

The introduction into modern ships of war of quick firing ordnance up to 8 inches has made the serving of ammunition one of the many difficult problems that confront the naval architect and the engineer. It also gives an idea of how long a naval engagement will last between modern ships, if they have a chance to do their best, to consider that a ship equipped as the "Chitose" will be can fire all the ammunition she can carry in two hours.

Report of the Hamilton Electric Lighting Plant.

The report of the superintendent of the city electric lighting plant of Hamilton, Ohio, was recently presented for the eleven months ended December 31, 1897. This plant consists in brief of two 208-hp Abendroth & Root water-tube boilers, one 110, one 350 and one 450-hp tandem-compound condensing Hamilton Corliss engines, belted to clutch couplings on a line shaft, to which are belted three 100-light Western Electric multiple arc machines and two 60-kw Stanley two-phase alternators. Previous to February 1, 1897, the plant was rapidly running down, both mechanically and financially, and its control was turned over to Mr. W. N. Gray, of the consulting engineering firm of W. N. Gray & Co., with the request that he put it in good mechanical condition and bring it, if possible, onto a paying basis. Many changes, all in the line of improvements, have been made, some of which are as follows: A 180-kw alternator has been substituted for a 60-kw alternator, previously installed. A testing board, with instruments, has been constructed to test meters, fan motors, lamps, etc., as well as station instruments. The transformer service has been quite reorganized, large transformers having been installed in the business districts, each serving as a centre of distribution, the present arrangement comprising fourteen transformer centres with twenty-two transformers, with an aggregate capacity of 3730 lights. The number of transformer centres is quite satisfactory, considering that the total number of consumers is 203, these being considerably scattered in a city of the size of Hamilton, but the capacity of the transformers appears altogether too large for the number of lamps wired, which is only 3828. The motor load on the two-phase circuits is being vigorously developed and commercial arc lighting on the same circuits is to be used. The payroll has been reduced by $200 a month under the new management and the load has been considerably increased, the incandescent light customers having increased about 30 per cent., the number of lamps by 1000, and the receipts about 89 per cent. The rates made on alternating current are very low, the standard being 8 cents per kw hour, with a discount of 25 per cent. on a monthly consumption of 200-kw hours or over. The average cost per kw hour is given as 3.4 cents, the coal burned per kw hour being on an average 9.1 pounds.

Annual Report of the American Bell Telephone Company.

From the report of President John E. Hudson, read at the annual meeting of the American Bell Telephone Company, Boston, March 29, the following statements are quoted:

The underground system is now in use in 130 of the exchanges, and 282,634 miles of exchange wire, that is, nearly 50 per cent. of the total mileage in the United States, are now carried by means of underground conduits.

The output of telephones and the increase of the number of exchange subscribers reported by the companies operating under our licenses are unprecedented in the history of the business. In fact, the gain of exchange stations recorded for the past two years equals the aggregate gain of the six years which preceded.

Almost the entire increase for the last year is made up of stations connected by metallic circuits.

During the year the Long Distance Company's lines have been extended to reach Omaha in the West, Minneapolis to the North, and southerly to Petersburg and Norfolk. There were in operation on the 1st of January, 1898, 8778 miles of pole line and cable and 116,116 miles of wire connecting 238 offices; a gain during the year of 1433 miles of pole line and cable, 8706 miles of wire, and fifty-five offices.

In all there are thirty-five companies reached whose systems furnish our long line terminals. These companies report a total of 325,250 stations, of which 146,394 (45.01 per cent.) are equipped with metallic circuits; and of these 146,394 stations 22,928 are equipped with long distance cabinet sets.

The number of exchange stations operated under the licenses of this company are 384,230. This equals, within a few thousand, the aggregate number of exchange stations in all of continental Europe. Next to our own country comes the German empire with 122,632 exchange stations (1896), and next Great Britain with 85,316. In the United States conversation is now had by subscribers over distances of 1800 miles, which is twice the length of line anywhere else employed for telephonic use.

The new construction completed in 1897 by companies with which we have contract relations amounted to $8,712,914. Of this sum $4,865,317 was expended upon exchange construction and equipment, and $3,847,596 upon toll lines. In addition to the above, $1,484,332 was invested in real estate to be used for company and exchange purposes.

The entire expenditure for construction, including real estate, to the close of 1897 has been $97,946,102.

The Long Distance Company had invested up to December 31, 1897, in line construction, franchises, equipment and supplies, $13,888,752. The company shows an increase in gross earnings in 1897 over 1896 of 16 1-10 per cent., the amount for 1897, gross, being $1,879,294.

The following table shows the condition January 1 of the companies with which the Long Distance Telephone Company connects:

	1898.	1897.	1896.
Number of companies	35	32	29
" stations	325,250	259,198	201,987
Connections by metallic circuit	146,394	105,091	78,756
Per cent. of metallic-circuit connections	45.01	40.54	38.99

Extra territorial and toll lines show: Miles of pole lines January 1, 1898, 67,791, an increase of 7238; miles of wire, 324,883, increase, 56,017.

Average number of toll connections is 75,208, or a total per year of about 24,200,000.

The toll revenue reported by all companies for 1897 was $4,435,515, excluding earnings of the American Telephone & Telegraph Company.

Earnings of extra territorial lines included in the above $1,949,132, of which the Bell Company received $211,507, an increase of $29,241.

The following table shows the increase of the various features of the business for the past four years:

	1897.	1896.	1895.	1894.
Telephones, December 20	919,121	772,627	674,976	582,506
Exchanges, December 31	1,025	967	927	867
Branch offices	937	832	686	572
Total miles wire	626,400	536,845	459,728	396,674
Number of circuits	295 904	264,465	237,837	212,074
" employees	16,682	14,425	11,930	11,094
" stations	384,230	325,726	281,695	243.432
" daily connections	3,099,472	2,630,071	2,351,420	2,088,152

A table of the financial statement may be found in the financial column on another page.

Telephonic Communication of Important News.

It is alleged by the daily press that the Chicago Telephone Company has arranged, in the event of a declaration of war, to give every one of its 18,000 subscribers the information immediately upon the receipt of the news in its central offices.

Magnetism in the Human Head.

A scientific paper some time ago reported that the following experiment was made under the direction of the French Academy of Sciences, with the body of a man who was guillotined. A moment after the operation the head was placed on a vertical pivot on which, after some oscillations, it turned to the north and remained stationary. It was then turned part way by the professors in attendance and it moved back into the same north and south position. This was repeated until "the final cessation of the organic movement."

New Brazilian Tariff.

The State Department at Washington gives in a consular report a translation of a portion of the new Brazilian tariff, showing the changes made in the tariff of 1896 in the principal products exported from the United States to Brazil. Copper wire, plain, is reduced from 1 milreis (14 cents) to 400 reis (5.6 cents) a kilogram; copper wire, insulated with cotton, paper or rubber, is reduced from 1600 reis (22.4 cents) to 900 reis (12.6 cents) a kilogram; copper wire plated, gilded or covered with silk, reduced from 4200 reis (58.8 cents) to 2400 reis (33.6 cents); wire prepared for telegraph, telephone or electric light lines pays 20 per cent. ad valorem.

Important Decision in the Gas Industry.

The monopoly of the Welsbach incandescent mantle has been sustained by the decision of Judge Townsend of the United States Circuit Court, handed down in New York City on the 25th of March. The litigation involved the claims on the combination with an incandescent mantle of strengthening substances intended to sustain it during transportation and to be burned off at the first ignition of the gas. The decision was in favor of the complainant, the Welsbach Light Company. This decision, if not reversed, will stop the competitive manufacture of incandescent lamp mantles which has been going on all over the country of late, and will undoubtedly increase considerably the price of the mantles.

Electric Railroads in Corea.

A company known as the Seoul Electric Company, composed entirely of Coreans, the governor of the city being president, has obtained a franchise for lighting the streets and residences of the capital of Corea, and operating street railroads by electricity. The capital of the company is $300,000, of which one-half has been paid in. According to Mr. H. N. Allen, consul-general of the United States, the company has made a contract with Mr. H. Collbran, of Denver, for the construction and equipment of a trolley railroad about 6 miles in length. A cash payment of $100,000 was made with the contract and the work will be rapidly carried on. It is thought that the traffic will at first be largely made up of curiosity seekers until the convenience of the road as a regular means of transportation is recognizd.

Industries Based on Patented Inventions.

In the report of the Commissioner of Patents for the year ending December 31, 1897, there are given many aggregate figures of the larger industries, some of which are included in the electrical field. In the electric light and power industries, as reported in 1880, there were but three establishments in the country, employing 229 persons, and producing an annual output valued at $458,400. At the close of 1894 there were in the United States 2124 central stations, beside many thousands of isolated plants. The capital invested in the central stations is stated to have been $259,000,000, and the capital invested in the isolated plants was probably not less than $200,000,000. The number of persons employed was estimated at 45,000. The growth since 1894 will greatly increase these figures at the present time. The total mileage of electric railways up to October, 1897, is given as 13,765 miles, with an invested capital of over $846,000,000, and not less than 166,000 employees. At the close of 1896 there were said to be 965 telephone exchanges and 832 branch offices, using 537,000 miles of wire and employing over 14,000 persons. The total amount invested in telephone property is given for 1895 as $77,500,000.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE
AMERICAN AND FOREIGN
By Carl Hering.

Dynamos, Motors and Transformers.

ELECTRIC GENERATORS. Parshall and Hobart. Lond. "Engineering," March 18.—In this continuation of their long serial they discuss two circuit drum windings, alternating current windings and induction motor windings, a formula for the first being given, together with numerous diagrams.

COMBINED DYNAMO AND ENGINE.—Lond. "Engineering," March 18.—A brief illustrated description of a direct-coupled set for use on board ships; the dynamo has four poles and a series-wound drum armature with only two sets of brushes.

WINDING MAGNETS. Stone. "Elec. Eng.," March 24.—A set of curves, accompanied by a very brief description, for facilitating the calculation of the space required for the winding on a magnet spool. In the curves allowances have been made for imperfect winding, and it is claimed that the differences in the thickness of the insulation used by different wire manufacturers is not sufficient to give any trouble; the curves are based on the average thickness of the principal makers; the curves also give the percentage of copper and the total space occupied by the wire, besides the turns per square inch and the weight per cubic inch for different sizes of cotton-covered magnet wire. (The results appear to be only approximate.)

MAGNET AND ARMATURE WINDINGS.—"West. Elec.," March 26.—A short illustrated article, in which the difficulties in making a smooth, regular winding are pointed out, but the only two ways given for overcoming these troubles are "long practice" and figuring. A method of winding an armature is shown. The article is somewhat vague and unsatisfactory.

DESIGN OF DIRECT-CONNECTED MOTORS. Dunn. "Elec. Eng.," March 31.—The first part of an article on considerations governing the design of such motors made by the Crocker-Wheeler Company. In direct current motors the speed is necessarily low and the means by which this is accomplished are described; it is chiefly due to the high quality of the material, the use of many poles, an armature of large diameter, a construction involving a minimum amount of labor and proportions which give the minimum losses. The typical field is made up of cast iron, into which are cast welded the radial wrought iron cores on which removable pole pieces are bolted, giving a "long" air gap (meaning, apparently, perpendicular to the lines of force and the axis).

TWO-COMMUTATOR DYNAMO.—"Elec. Eng'ing," March 24.—A brief illustrated description of a plant in Chicago in which is installed a 60-kw double-wound dynamo having two commutators, from each of which 110 volts is obtained; the lights are divided equally over the 110 volt circuits, while the two circuits together in series are used for running the elevators; it is very necessary that the two lighting circuits be equally balanced. The dynamos are compound wound, the series coils being equally divided over the two circuits.

EVOLUTION OF THE STEAM ENGINE AND DYNAMO. Child. "Eng. Mag.," April.—A short article on the evolution of the dynamo and the steam engine and the effect of each on the other in their development. He believes there is no limit in sight at which the growth in size of the dynamo and engine combinations must cease; at present steam engines are built as high as 15,000 horse-power and dynamos 5000 horse-power, but there is no reason why they should not be made three or four times as large if there is any occasion for it.

BEARINGS FOR ELECTRICAL MACHINERY. Fells. "West. Elec.," March 26.—Brief illustrated descriptions and practical hints concerning some different forms of bearings.

Lights and Lighting.

NERNST LAMP.—Lond. "Elec.," March 18.—A note stating that in technical circles in Germany doubt is expressed whether this new lamp can be patented, attention being drawn to the fact that Planté showed the principle of this lamp in his published "Researches;" it is not certain, however, whether precisely the same principals were used.

STREET LIGHTING IN PARIS. Reyval. "L'Eclairage Elec.," March 12.—A description of the method used in lighting the Place du Théâtre Francais in Paris, where about seven lamps, or groups of lamps, are to be used; the alternating current is to be used.

ALTERNATING CURRENT LIGHTING. Meyer. "Elek. Anz.," March 13 and 17.—An article discussing the alternating system for lighting, with special reference to arc lamps, a form of which is described and illustrated. The article does not seem to contain anything of importance.

LAMPS AND APPARATUS FOR 200 VOLT CIRCUITS. Byng. The conclusion of the discussion of his paper (see THE ELECTRICAL WORLD, March 19, p. 356) is published in the English journals March 18, it being apparently more complete in the Lond. "Elec." and "Elec. Eng."

LAMP SOCKET.—"L'Ind. Elec.," March 10.—A brief illustrated description of a new socket, which does away with the plaster, and which facilitates the recovery of the socket from burnt out lamps.

ARC LAMP SUPPORT.—"L'Eclairage Elec.," March 12.—An abstract of the illustrated description noticed in the "Digest," Jan. 29.

Power.

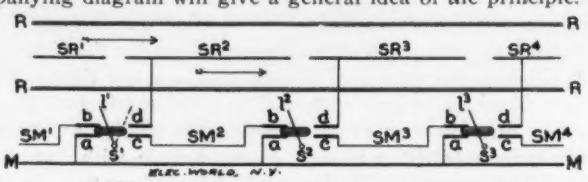
HELENA.—"Elec. Eng.," March 31.—A brief illustrated description of the plant near this city of Montana, utilizing the power of the Missouri River. There are four 650-kw direct-connected three-phase generators, operating at 500 volts, which is raised up to 10,000 by transformers; the distance of the transmission is 11 miles.

CENTRAL POWER PLANTS ON BOARD SHIP. Aldrich. "West. Elec.," March 26.—A reprint of the article noticed in the "Digest," last week.

WAVE MOTOR.—"Elec. Eng.," March 31.—An illustrated description taken from a recent patent to Bunnell.

Traction.

SURFACE CONTACT SYSTEM.—Lond. "Elec. Rev.," March 18.—A brief illustrated description of the Kingsland system. The accompanying diagram will give a general idea of the principle. M M



is the main, R R the rails and S R the sectional rails or contact points. The passing car, say going to the right, throws the switches successively into the position shown in dotted lines and leaves them there, thus each switch need be operated only once and does not have to be brought back again in order to break the circuit, as this is done by the succeeding switch; when all the switches are in one direction there is no electrical connection between the main and any of the sectional rails. In practice, however, the system is not so simple, as means are provided for operating the switches electrically and automatically; this is accomplished by a cylindrical commutator, which is partially rocked by means of an electromagnet; one pair of contacts cannot be disconnected until the other pair are connected, and thus there can be no sparking at these contacts; the switches are described and illustrated; the car makes a contact with one section before it leaves the other, and the operation of first making a contact sends a current through the magnet, thus operating it, thereby cutting in the new section and cutting out the old one; there is no force required to keep the switch in position, as it is self-locking; there are no working springs whatever and it is thought that a switch cannot easily get out of order. The switches are placed in small cast iron boxes with waterproof covers. If a switch should fail, the car could not proceed, but it is the work of only a few minutes to open a box and change the switch; no electromagnets or storage cells need be carried by the car, and therefore the same car may be used for a combined overhead and surface system.

HANOVER.—"Elek. Zeit.," March 17.—A long abstract of the official reports for the past year for this system of lines, on which the mixed accumulator and trolley system is used. Unfortunately, the report does not give detailed data regarding the economy of this system, as it refers chiefly to a description of the large extensions which are being and have been made. The maintenance and renewing of the accumulators cost 11.54 cents per car per month, or 0.30 per km. on the mixed system and 0.51 per km. for the portion on which the accumulators are used. The power stations are to be used also for the distribution of light and power; the total cost of operation as compared with the income is 63.8 per cent. as compared with 68.2 for the previous year; the total length of the lines is 130 km. This is followed by brief descriptions of the new stations. After setting aside the necessary reserve funds a dividend of 5 per cent. was declared.

ELECTRIC RAILWAY STATISTICS FOR EUROPE.—"L'Ind. Elec.," March 10.—A twenty-page supplement containing tabular statistics for all the railways in Europe classified under the different countries. It also contains a brief account of those under construction. In a concluding table the chief information is briefly summarized; Germany leads with sixty-five lines, having a total length of 1138 km., followed by France with forty-four lines and 397 km., Switzerland with twenty-three and 146 km, England with twenty-two and 134 km.; the total is 204 lines, having a length of 2259 km., involving a power of 68,106 kilowatts and the use of 4514 motor cars; thirteen of these lines are run by accumulators, of which six are in Germany and four in France; eight use the central rail, eight the conduit system, three the mixed trolley and accumulator system, and the remaining 172 the trolley system. Similar statistics are given for the year before, so as to facilitate comparison.

BEST ARRANGEMENT OF RAILWAY RETURN FEEDERS. Natalis. "Elek. Zeit.," March 17.—A very long mathematical article, in which he discusses, with the aid of numerous diagrams, the return current and the use of return feeders, giving formulas for their rational calculation under the assumption that the road starts from the central station and is equally loaded at all points; the results do not admit of being abstracted.

NEW TROLLEY SYSTEM.—Lond. "Elec. Eng.," March 18.—A brief illustrated description of the system proposed by Kenway. The wire is suspended on the side of the street and the trolley pole extends from the top of the car to the side; in place of the trolley there is a vertical bar which slides over the wire, and toothed wheels at the top and bottom of this are so arranged that two contact bars can pass each other in the case of a double track system. Editorially it is said that difficulties would arise with this system on convex curves.

MOTOR CARRIAGE. Oppermann system. Lond. "Elec.," March 18.—A brief illustrated description of a form which has been in use in Paris for some months. It appears to have performed some difficult feats, one of them being to ascend the Montmartre Hill with four passengers and another to successfully climb a 14.5 grade. The chief objects of the design are freedom from vibration and noise, simplicity of construction and control, combined with high efficiency; the control allows of six different speeds; the weight is 28 cwt., of which 12 is for the accumulators.

ACCUMULATOR TRACTION IN ROME.—"L'Eclairage Elec.," March 12.—A note on this line, the experiments on which have been so satisfactory that ten accumulator cars are to be added on lines now run by horses.

ELECTRIC RAILWAYS. Pellissier. "L'Eclairage Elec.," March 12.—Illlustrated descriptions of various accessories, taken apparently from patent specifications.

EFFICIENCY OF MOTOR GEARING. Fischinger. "L'Elec.," March 19.—A reprint of the tables of data from the article noticed in the "Digest," Jan. 15; see also March 19.

TRACTION ON THE ERIE CANAL.—"Elec. Eng.," March 31.—A brief illustrated description of the plan of Short, which is to be tried; the boats will be hauled by means of rack and pinion locomotive on a track and supplied from an overhead trolley wire; a mining locomotive, powerful enough to tow five boats of 250 tons each, will be used, the speed being 6 to 8 miles per hour.

ELECTRIC MOUNTAIN ROADS.—"Eng. Mag.," April.—A brief abstract of a recent description from "Genie Civil" of the road up the Gorner Grat, another description of which was referred to in the "Digest," March 19.

CONDUIT RAILWAY.—"Elec. Eng.," March 24.—A brief illustrated description of the improved Siemens & Halske method, based on and similar to the one used at Budapest.

Installations, Systems and Appliances.

PARIS. Journet.—A very long profusely illustrated article from "Genie Civil," and reprinted under separate cover. It is a very full description of the new electric lighting station on the Quai de Jemmapes in Paris, of the Compressed Air Company, which lights one of the sections of that city. Formerly they had several stations and sub-stations, but these have now been combined into one large one with a small number of central distribution stations; one of the features of interest is that the five-wire system is used, the outside voltage being 440; at the distribution centres the currents are distributed directly without transformation and are balanced by regulators and accumulators. A short abstract of the article is given in the "Eng. Mag.," April.

SYNCHRONIZING ALTERNATORS. Oliver. Lond. "Elec.," March 18.—A contribution to the discussion between H. H. N. and Kensit (see "Digest," March 19 and 26). He differs with the latter, but admits that under certain conditions, which are hardly normal, a regulation of the exciting current would be sufficient; in these cases the governors of one or both engines are not absolutely free and do not govern to the same percentage variation between no load and full load; he discusses the action and shows that under the conditions which he gives the only effect which the alteration of the exciting current can have is to change the wattless synchronizing current passing between the machines.

GLASGOW RAILWAY LIGHTING PLANT.—Lond. "Elec. Eng.," March 18.—In this, the concluding article of the series (see "Digest," last week), an illustrated description is given of the pumps, elevators and signalling arrangements.

BRESLAU.—"Elek. Zeit.," March 17, and "Zeit. f. Beleucht.," March 10.—Long tabular extracts from the report of the operation of this station for 1896-7.

TORQUAY.—Lond. "Elec.," March 18.—A brief illustrated description of this high tension alternating current municipal station in which rectifiers are used for the street arc lamps.

CENTRAL STATION ACCOUNTS.—Lond. "Elec.," March 18.—An analysis of the accounts of several small stations in England.

ECONOMICAL PRACTICE IN CENTRAL STATIONS. Feldmann. "L'Eclairage Elec.," March 12.—A continuation of the long abstract noticed in the "Digest," last week.

ELECTRIC LIGHTING IN JAPAN.—Lond. "Elec. Eng.," March 18.—A note stating that of the forty-two large cities in Japan having a population of 26,000 or over, electric lighting systems are installed in twenty-four.

SEPARATE SWITCH PILLARS FOR EACH UNIT.—Lond. "Elec. Eng.," March 18.—Answers to a request to name the objections to such a system in a central station.

HOSPITAL PLANT. Weller. "Elec. Eng.," March 31.—An illustrated description of the plant at the Boston City Hospital.

Wires, Wiring and Conduits.

FREE WIRING SYSTEMS. Rider. Lond. "Elec. Eng.," March 18.—A reprint of a report to the Plymouth Company on the wiring of houses; some brief extracts are given in the Lond. "Elec." He does not approve of the system adopted by the free wiring syndicate, the wiring for which is not free, as might be supposed; a much fairer system would be to let each consumer pay the cost, but to spread the payment over a considerable time, a system which he proposed in 1894, and which has been in successful operation at Bolton ever since; he considers it unwise for central stations to undertake the wiring work, and recommends instead that where a customer desires to avail himself of an easy payment system the quotation for such a customer should be made out in a special form binding the contractor to carry out the work to the satisfaction of the central station and allowing a discount of 5 per cent. for cash; the consumer ought then to agree to pay by means of eight equal installments, thus spreading the payment over a period of twenty-one months, payment being thus made to the central station.

The latter journal in an editorial also recommends for consideration the method recently adopted by the House-to-House Company for popularizing the light and encouraging its adoption; this consists in giving such householders a limited installation free of all initial expense and any additional charge for the current; this consists of six lamps of 16 candle-power, the consumer paying for the current at the usual rate, but agreeing to a minimum charge of 25 cents per lamp and a meter rental of 50 cents per quarter; to protect the station from transitory customers it is stipulated by the station tht if the rent of the premises expires earlier than two years an agreement on the part of the landlord must be arrived at; moreover, before any extensions of that installation shall be carried out the cost of the work shall be paid for by the consumer, not exceeding $30, and the latter has the option of making the purchase at any time. This system has been in operation for the past two months, and it has been so successful that a further scheme for supplying consumers with a larger number of lights is contemplated.

AIR INSULATION CABLES. Barbarat. "L'Eclairage Elec.," March 12, and "L'Ind. Elec.," March 10.—An abstract of a recent paper referring to those used in Paris; the abstract contains little of importance. In some cables made in America with paper and paraffin an economy of 40 per cent. was obtained over those made with gutta percha; in Paris trials were made with cables insulated with paper and dry air and having an economy of "two-thirds" over the American cables. It is important in laying the cables to provide for accessibility for repairs; when a fault is found, dry air is forced into the cable at the two ends, and after several hours the fault disappears. He thinks the cables could be used to advantage for the distribution of power.

METHOD OF SECURING WIRES. Knorre. "Elek. Anz.," March 13.—An illustrated description of the multiplex system of securing insulators on walls for open circuit wiring.

ALUMINUM VS. COPPER FOR CONDUCTORS.—"Elec. Eng.," March 1.—An extract from a recent discussion. Hunt has claimed that aluminum at 29 cents per pound is a more economical conductor than copper at 14 cents. Field claims that the additional diameter of the aluminum will increase the cost of insulation, and the surface leakage will be greater unless the insulation is increased; the electrostatic capacity will increase; if such a wire is bent once through 90° and back again it will break, whereas ordinary copper conductors will stand fifteen to twenty of these bendings; he therefore believes that it is very doubtful whether aluminum conductors will prove practicable; he recommends very highly the use of aluminium fuses for switchboard work, as they are not altered by the current; Dow, who agrees with this, calls attention to the increased stress due to wind pressure in overhead lines; the larger diameter of the aluminum would require a much greater strength of poles, or about three times as many.

WIRE AND WIRE MANUFACTURING. Barnett. "Eng. and Min. Jour.," March 26.—The first part of an article on a wire trust, the final formation of which is apparently assured.

Electro-Physics and Magnetism.

THE ARC AS A TELEPHONE. Simon. "Wied. Ann.," No. 2; noticed briefly in the Lond. "Elec.," March 18.—He discovered and studied the following phenomenon: If the circuit of an arc lamp is close to another traversed by a feeble intermittent current the arc emits a loud rattling noise; intermittent currents produce similar ones in the arc, which affect the temperature and produce the noise. If a microphone is placed in the primary circuit, the note of a tuning fork, the sounds of whistling, tapping and singing are reproduced by the arc with every detail of intensity, pitch and quality; sound waves acting directly on the arc produce changes of density and fluctuations of the current, which could be transmitted to a distance and reproduced by a telephone at the other end.

LOCATING OBJECTS BY RONTGEN RAYS. Morize. "L'Eclairage Elec.," March 12.—A reprint of an Academy note, in which he describes a simple and satisfactory process. A position is first chosen in which the object is easily seen with the screen; a small disc of lead is then secured to the patient with wax in such a position

that it appears to cover the shadow of the object in the screen; another disc of lead is similarly placed on the other side of the body for the same exposure; this is repeated with the tube in some other convenient position; the location of the body will then be at the intersection of the two lines, the ends of which are shown on the surface of the body by these pieces of lead; the exact position can then be determined by drawing a quadrilateral on paper from measurements made on the body between these points. In less than 10 minutes it is possible to locate an object to a precision of 1 to 2 mm.

TRANSFORMATON OF X-RAYS BY MATERIALS. Sagnac. "L'Eclairage Elec.," March 12.—The beginning of a long article discussing secondary rays, their emission, and the propagation, diffusion and luminous action of X-rays. He had previously shown that a comparison of X-rays with luminous rays does not lead to any positive analogies, but when material intervenes there is a diffusion or dissemination, and he shows that this is a transformation of the X-rays by the material into a species of new rays, which approach the ultra violet rays, and which form a sort of prolongation of the group of known X-rays somewhat as the Hertzian or calorific rays constitute an extension of the luminous spectrum.

VELOCITY OF CATHODE RAYS. Majorana. "Acc. di Lincei," August; abstracted briefly in the "Elek. Zeit.," March 17.—He describes a method which he used to measure the velocity of these rays, and obtained the figure 600,000 metres, although the error is such that it may be 150,000; Thomson, in 1894, gave the figure 190,000; the present author is inclined to believe that the rays vary in their velocities between 100 and 600 km. per second.

CATHODE RAYS IN AN ALTERNATING FIELD. Ebert. "Wied. Ann.," No. 2; abstracted briefly in the Lond. "Elec.," March 18.—He proves that the deflection of cathode rays by electric oscillations takes place in a well-defined manner when the current producing the cathode rays is quite independent of the deflecting current. It is thought the experiments indicate a valuable and sensitive method for investigating the secondary E. M. F. of open transformers.

FRICTIONAL ELECTRIFICATION. Coehn. "Wied. Ann.," No. 2; abstracted in the Lond. "Elec.," March 18.—He succeeded in discovering a definite law, namely, that the frictional series of insulating substances is the same as the series of their dielectric constants. He found that when a substance has a high dielectric capacity it would be positively electrified by friction or contact with a substance of lower dielectric capacity; the law applies to insulating liquids as well as solids.

THEORY OF LORENTZ. Lienard. "L'Eclairage Elec.," March 12.—A short mathematical article.

DOUBLE REFRACTION IN WOOD. Mazzotto. "Acc. d Lincei," August 1; abstracted with a diagram and table of results in the "Elek. Zeit.," March 17.—He made experiments with several kinds of woods. In an article, the abstract of which follows this, but is published in the issue of August 15 of the Italian journal, he discusses the Maxwell ratio between the electrical constants of pine wood.

SHORT WAVES. Lamotte. "L'Eclairage Elec.," March 12.—An abstract of a French Physical Society paper describing researches with waves which are shorter than the fundamental waves in the systems of Lecher and Blondlot.

GRAPHICAL REPRESENTATION OF ALTERNATING POTENTIALS. Goerges. "Elek. Zeit.," March 17.—A reprint of a long paper which is a elaboration of the one read before the Union of German Electrical Engineers last June. After stating that the potential is the quantity to which all others are reduced, he shows how it may be studied by a graphical method, the principles and applications of which he describes. The article does not admit of being abstracted.

MERCURY ARC LAMP. Arons. "Wied. Ann.," 62, p. 569; abstracted briefly in "L'Eclairage Elec.," March 12.—A reply to the recent article of Gumlich. At the cathode the light vacillates and the discharge takes place on portions which change incessantly; the surface of the mercury is continually in movement; the temperature is higher on the anode side and the mercury distils from this to the cathode.

PHOTO-ELECTRIC PROPERTIES OF SALTS. Elster and Geitel. "Wied. Ann.," 62; p. 599; abstracted briefly in "L'Eclairage Elec.," March 12.—They studied the photo-electric properties of colored salts obtained in the vapor of alkaline metals.

DISTORTION MEASUREMENTS IN SCIAGRAPHY. Schmidt and Fuchs. "West. Elec.," March 26.—A short article on the distortions of the shadows, which it is claimed are well known to all experimenters with X-rays; they give the results of experiments "to determine the limits of this variation for practical purposes" (but what variation is meant is not clear); these limits are said to give approximate information on the distortion when the distance of the tube and the thickness of the object are known; they also speak of a focus point and focus line, the meaning of which is not quite clear. They found that the distortion is directly as the distance of the object from the focus line, and directly as the distance from the focus plate; the results are given graphically and enable the distortion to be found for different conditions.

RECENT APPLICATIONS OF RADIOGRAPHY. Goodspeed. "Elec. Eng.," March 24.—A brief abstract of a recent Franklin Institute lecture; the abstract contains very little information. Regarding the nature of X-rays, he states that at present the consensus of the best opinion is that these rays are produced by transverse vibrations in the ether, similar in nature to ordinary light, but of a vastly greater frequency; a quotation from the opinion of Stokes is given.

Electro-Chemistry and Batteries.

ELECTRO DEPOSITION OF METALS. Graham. Lond. "Elec. Rev.," March 18.—In this continuation of his Royal Society paper (see "Digest," last week) he continues the description of his tests to investigate the cause of the drop in the current. He states that the copper thus deposited at high current densities is neither much harder nor less ductile; in sheet form it can be doubled and opened without cracking, and if deposited in wire form it can be drawn to any fineness. His experiments were made with a saturated solution of sulphate of copper; other experiments showed that the rate at which the copper can be deposited is approximately proportional to the amount in solution; other experiments also showed that the substitution of many smaller jets for a large one produce discoloration along the lines where the currents meet.

DEPOSITING NICKEL.—"Elek. Anz.," March 10.—A long abstract of the article by Foerster, which was abstracted in the "Digest," Oct. 16, 23 and Jan. 1.

TREATMENT OF ORES CONTAINING PRECIOUS METALS. Webber. "Jour. Inst. Elec. Eng.," March.—A reprint of his complete paper, with the discussion, noticed in the "Digest," Feb. 19, 26, March 5, 12 and 19.

ELECTROLYTIC ALKALI. Steinhart and Vogel. Lond. "Elec.," March 18.—A brief communication discussing the low efficiency of the Hulin process (see "Digest," March 26), which is only 69.3 per cent. They have worked in a similar direction, making a large number of experiments with fused lead chloride by itself and with carbon anodes; when properly done, a current efficiency of 95 per cent. can be obtained; they account for the 19 per cent. loss of efficiency in the Hulin process by the fact that the chloride of lead is not decomposed by the current, but simply reduced to metallic lead by the sodium with the re-formation of sodium chloride; the primary expenditure of 12 per cent. of the current for the formation of lead chloride must result in a total loss of efficiency of 24 per cent.

STORAGE BATTERY. Crowdus system. "Lond. "Elec.," March 18.—A brief description of this cell, which is claimed to have interesting, original features. The chief aim is a decrease in weight and cheapness of manufacture. The positive plate is made of thin rolled sheet lead, punched with rectangular openings and perforations for connecting the plates both top and bottom; in the recesses formed the active material, which is a hard porous paste of red lead, is placed; the negative plate is made of aluminum, but is otherwise similar to the other; the weight of the lead support as compared with the active material is as one to two. The forming bath consists of one-third of a saturated solution of sulphate of zinc and 15 per cent. by volume of sulphuric acid, dummy plates being used as anodes; the current is about 1 ampere for every 3 square inches; pure zinc is thus deposited on the negative plates and is rapidly redissolved, producing hydrogen, which reduces the lead to spongy lead; the time of formation (of the spongy lead plates) is about two hours, which is about one-fifteenth of the time usually used; the same solution can be used over again indefinitely; the positive plates are then formed from the negatives, and will give almost their full output on the first discharge. There is a perforated separator between the plates; to prevent the capacity of the negative elements from decreasing, a small amount of zinc sulphate is added to the electrolyte of the finished battery. A description of this battery, taken apparently from the patent specifications, is published in the Lond. "Elec. Rev.," and was criticised unfavorably in that journal the week before.

ACCUMULATOR CONSTRUCTION. FitzGerald. Lond. "Elec. Eng.," March 18.—In this installment of his long series (see "Digest," April 2) he discusses the question of celluloid and similar compounds. He is very positive in saying that except on a small scale celluloid should not be used for accumulator boxes, the chief objection being its inflammability. He is, however, experimenting with a substance called pyroxylin, which burns only as long as it is in contact with the flame, and believes this can be used safely for boxes, although elsewhere he states that the pure material should only be used in the construction of the peroxide plate; it appears that this material, mixed with camphor, produces celluloid.

RISE AND PROGRESS OF ELECTRO-CHEMICAL INDUSTRIES. Swan. "Jour. Inst. Elec. Eng.," March.—A reprint in full of his inaugural presidential address, which was noticed in the "Digest," Feb. 12.

CARBON CONSUMING CELL. Reed. "Elec. Eng.," March 24.—A brief reply to the description of the Blumenberg cell noticed in the "Digest," March 19. The oxidation of carbon either to the mon-oxide or di-oxide by such a process could not evolve energy, no matter what metallic oxides were used; the total energy resulting from the two reactions of decomposing water and subsequently oxidizing carbon would be the same as though the carbon acted directly on the same, no matter what metallic oxide was used; the calculated counter E. M. Fs. for the two assumptions that the di-oxide or mon-oxide is produced are 0.21 and 06.4 volt. If any electrical energy is evolved from a cell having these reactions as the final result, it must be derived from the heat of the furnace; that is, it must be thermo-electric; but such reactions would not be possible under the conditions stated without the simultaneous formation of hydro-carbons involving an energy loss. The statement that natural ores could be used can apply only to the oxides of copper, as that is the only common

metal, whose oxide exists in nature as an ore, which carbon has sufficient energy to reduce without absorbing external energy.

GOLD FROM SEA WATER.—"Eng. and Min. Jour.," March 26.—An editorial calling attention to the claims of a company which has established works on the coast of Maine, and claims to have obtained gold and silver from sea water. The nature of the machine is kept a profound secret; according to a report issued and claimed to give the result of a week's work with an apparatus large enough to be considered a unit, 9.34 pennyweights of gold, valued at $9.60, was obtained, the cost of extraction being 75 cents. The editorial discredits the report, and considers this an attempt to impose on the credulous; it is admitted that gold is contained in sea water, and according to a recent paper by Don, read before the Amer. Inst. of Min. Eng., in Feb., 1897, the amount averaged 0.71 grain per ton, presumably in the waters around New Zealand.

Units, Measurements and Instruments.

ALTERNATING CURRENT VOLTMETER. Ebert and Hoffmann. "Zeit. f. Instrumentenkunde," Jan.; abstracted briefly in the Lond. "Elec.," March 18.—They devised a new form which consumes no current, has a small capacity and a sensitiveness variable within wide limits. The principle is the same as that of the plate electrometer of Bjerknes; a thin rectangular plate of aluminum hangs vertically by a quartz fibre between two parallel vertical plates and at an angle of 45° with them; the plates are the terminals of a condenser which are inserted in the alternating circuit as a shunt; the electrostatic forces, whatever their direction, tend to turn the suspended plate into a position parallel to the lines of force; the deflections are read by means of a mirror and are dampened magnetically. It may be used for sinusoidal currents or any others; the effective voltage is proportional to the square root of the arc of the deflection; the instrument is compact and is not subject to external influence; the sensitiveness may be reduced by moving the condenser plates; the calibration curve is perfectly straight from zero to 2000 volts, and the effective tension of alternating currents with frequencies up to 1000 per second has been successfully measured.

SHIELDED MEASURING INSTRUMENTS. McWhirter system. Lond. "Elec. Eng.," March 18.—A brief illustrated description of these instruments, in which an iron-clad bobbin is substituted for the ordinary brass one, as this has a marked effect in the freedom from effects of stray magnetic fields; the large mass of iron used does not increase the error due to residual magnetism; there is also a great reduction in the power necessary to operate the instruments, and thus the errors due to heating and atmospheric temperature are greatly reduced. The results of some tests made by Jamieson are given.

IMPROVED INTERRUPTERS. Van Huffel. "Zeit. f. Instrumentenkunde," Beiblatt, Jan.; abstracted briefly in the Lond. "Elec.," March 18.—The apparatus consists of a small water mill provided with four platinum pins dipping into mercury; the water which drives the mill falls on the mercury and overflows, carrying with it any impurities formed; the speed may be very carefully regulated; there is no preferred period of interruption; with this interrupter the spark obtainable is sometimes doubled, and the X-rays produced are greatly increased; it enables the full stength of the current to be exercised for a measurable period, which is not the case with the usual hammer interrupter; this latter could be improved by an additional spring, whch prolongs the contact, and by means of which an improvement of 40 per cent. is claimed.

INDUCTION COIL MAKE AND BREAK. Cremieu. "L'Elec.," March 12.—A reprint of a short illustrated Academy paper, which is presumably the one referred to in the "Digest," March 19. With the usual make and break the E. M. Fs. induced are reversed and have unequal values, but in his apparatus, a diagram of which is given, this is obviated. An alternating current is passed around a U-shaped electromagnet, between the poles of which oscillates a pivoted iron lever having a small coil at the end nearest the magnet, through which a continuous current flows; the other end of the bar in its oscillations touches two contact points on one side and two on the other, thus making contact with the two battery terminals which are flexibly attached to the lever. He claims that by this method the E. M. Fs. induced will be equal; the only objection is the large amount of energy lost, as the original E. M. F. must be doubled. The apparatus is reversible, so that an alternating current may be redressed into an undulating direct current. The contact points are so arranged as to yield against springs, in order that the precise moment of interruption may be adjusted to take place when the E. M. F. is zero, and in practice the sparks produced are therefore extremely small, while the loss of energy does not exceed one-quarter of the original amount.

DIRECT MEASUREMENTS OF THE PERIOD OF HERTZIAN OSCILLATIONS. De Combe. "L'Ind. Elec.," March 10.—A reprint of an Academy note describing the method which he used, and which is similar to that of Feddersen. The speed of the mirror was between 400 and 500 revolutions per second. If the period is not too small, the oscillations can be distinguished clearly with the naked eye; the measurements are made with the dividing engine; the number of oscillations in a single spark depends for a given period on the capacity of the exciter; he counted up to fourteen in one discharge; the experiments confirm the theory of Poincare and Bjerknes, according to which the exciter emits only radiations of a single wave length.

TESTING DIELECTRICS FOR IRON. Duane. "Wied. Ann.," No. 62, p. 544; abstracted briefly in "L'Eclairage Elec.," March 12.—He describes a method which consists in suspending the dielectric in the form of cylinders, in a revolving magnetic field; the deflection of cylinders of sulphur, paraffin and glass is practically independent of the velocity of the rotation of the field, which shows that the deflection is due to a coercive force.

MEASURING THE RESISTANCE OF LAMPS. Szapiro. "Elek. Zeit.," March 17.—A note stating that if in the method recently described (see "Digest," March 19) one of the lamps should fail, a portion of the lamp current would pass through the galvanometer and would destroy it. Moreover, he considers this method much too complicated in comparison with the results obtained; if in the usual method the resistance of the voltmeter is determined and the proper correction made, or if a static voltmeter is used, the results obtained will be more accurate and the measuring very greatly simplified than with the new method.

STORAGE BATTERY TESTING AT HIGH RATES. Kennedy. Lond. "Elec. Rév.," March 18.—The decrease in the capacity at high rates of discharge is partially due to internal resistance, but mostly to something which varies in different cells; if two different cells are first discharged at a rate at which their capacities are equal and then at high rates, the results can be plotted as curves from which the capacities for the same number of hours discharge, or the time of discharge for the same rate in amperes can readily be determined with the aid of horizontal or vertical lines joining the two curves. For all practical purposes cells may be compared in this way by making only two tests, one at which the two cells are alike and another at say one hour; a comparative figure is then obtained by dividing the ampere hours at the high rate with those at the low rate, this figure being unity for a perfect cell; the curves will be better in those in which the active material is in the form of a large thin surface. Although there are accepted methods for comparing other apparatus, there is no recognized method for getting good comparative results for different accumulators.

ACCUMULATOR TESTING. Appak. Lond. "Elec. Rev.," March 18.—A criticism of the article noticed in the "Digest," last week, in which it is claimed many important considerations were omitted. When the accumulator is intended for lighting purposes, where constancy of voltage is imperative, a comparison should state how thick the acid space is, or the distances between the plates, as there is a marked increase in steadiness with every fraction of an inch increase in the distance between the plates; the assumption that the results from one positive can be used for calculating those for a complete battery is claimed to be incorrect; no two kinds of plates, or even arrangements of the same plates, would give results that could be tabulated on one basis. In a brief reply on another page the original author claims that the meaning of his remarks was not correctly understood.

COPPER SAMPLES FOR CONDUCTIVITY TESTS. Sheldon. "Elec. Eng.," March 24.—A short article in which he calls attention to the necessity of adopting a standard system of softness for samples whose conductivity is to be tested. At present some of the difficulties are met by the purchaser sending inspectors to the factories to determine the conductivity before the wire is covered, and this is said to be the American practice for aerial line construction; to copper refineries and all buyers and sellers of bulk copper a standard method of treatment of the test samples is of great importance. As the Amer. Inst. of E. E. adopted the standard for soft copper, he endeavored to ascertain whether it was true that the soft condition is easily reproduced and he had some experiments made in which a wire was hard drawn, cut up into lengths, each of which was separately subjected to different annealing temperatures, one set in vacuum and another in hydrogen, the different temperatures being produced by sending currents through the samples and the temperatures being calculated from the resistance, which, in turn, was calculated from the current and voltage; the results are given and it is claimed that they show that annealing to a softness which shall give a maximum conductivity must take place at a high temperature regulated within rather narrow limits; the maximum softness will be obtained if the sample is melted, cast and cooled slowly; the conductivity depends largely on the amount of oxide of copper present, and this is greatly altered by melting. He concludes that it would therefore be better to subject all samples to the hard-drawn process.

TORONTO MAGNETIC OBSERVATORY. Stupart. "Can. Engineer;" reprinted in the "West. Elec.," March 26.—After a brief description of this observatory, he describes how trouble began with the disturbing influences of industrial currents. A study of the effects showed that the currents ordinarily used have little effect at three-quarters of a mile, and it has therefore been determined to remove the magnetic instrument to a point about 2 miles distant from any probable trolley route, and about 9 miles from the present location, "and continue what are certainly the most valuable and extended magnetic records outside of Europe."

Telegraphy, Telephony and Signals.

HUGHES PRINTER WITH THE MARCONI SYSTEM. Stecker. "Elek. Zeit.," March 17.—A reprint, with diagrams, of a short paper contributed from the Government telegraph department. He describes tests which were made to show that the Marconi system can also be used where great precision is necessary, as, for instance in combination with the Hughes printer; he endeavored to find whether when spark telegraphy is used it is better to use the Hughes or the Morse system; he found that the Hughes system could be used and that the speed was about equal to the mean speed of the

Morse system. He also describes a modification of the Morse system for spark telegraphy, by means of which the record is improved, and he obtained a speed which is almost equal to that of overhead lines and gives sharp points and lines, the improvement being based on a system proposed by Delany; the relay which is in the same circuit with the coherer does not operate directly on the Morse receiver, but an additional closed circuit is introduced.

MARCONI TELEGRAPHY. Andriessen. "Elek. Anz.," March 13.—Marconi found that by connecting the transmitter and receiver with one pole to the earth he could telegraph over larger distances, particularly when wires reaching high into the air were used; in the present article the author shows how this affects the system, and claims that it is not unlikely that electric waves then no longer take part in the transmission.

TRANSMITTER FOR CABLE TELEGRAPHY. Karrass. "Elek. Zeit.," March 17.—A brief illustrated description of a device recently patented by Langdon-Davies, and another devised long ago by Hefner-Altneck, which is based on exactly the same principle.

RECEIVER FOR WIRELESS TELEGRAPHY.—Lond. "Elec.," March 18.—A brief illustrated description of one recently exhibited by Miller and Woods, which is a very simple, conpact and portable form. The description is reprinted in the "Elec. Rev.," N. Y., March 30.

DOUBLE COIL TELEPHONE. Berthier. "Cosmos," Feb. 12.—A brief illustrated description of several forms with which he has been experimenting with some success. The object is to do away with the permanent magnet and substitute for it an electromagnet with 1 or 2 poles, thus diminishing the weight and increasing the force of attraction; the electromagnet is excited preferably by a battery or accumulator current; by means of a rheostat in that circuit the magnetism can be regulated so as to obtain the best effect; as there is no permanent magnet, the diaphragm is attracted only when the telephone is in use. In one of the forms in which he got the best results, the diaphragm had secured to it a small coil and core of soft iron, which is placed opposite to the single pole magnet, the end of which has a similar coil connected in series with the other, and through which the line current passes, while there is a larger coil below it, though which the battery current passes. In such a telephone the diaphragm may be made of non-magnetic material, and in trying a number of different substances he found that the metallic diaphragm gives the loudest sound, but that mica diaphragms give the best quality of sound. Such a telephone may be used as a receiver of transmitter, but it cannot well be used for long distances.

TRANSMITTING IMAGES ELECTRICALLY.—"El'ty," March 30.—A description of the telectroscope of Szczepanik, an Austrian, which has been noticed briefly in the daily papers. The present brief description is only of a general character, and is not accompanied by illustrations; it appears that he makes use of four mirrors "coated with an opaque substance," two each at the transmitting and the receiving ends; on these coatings single lines are scratched, so as to allow "of only a single line of light of the object under observation being exposed to the reflecting influence of the mirror;" both mirrors oscillate and are at an angle with each other; the single line of light which is reflected by both mirrors is made to generate a current through the medium of a selenium cell, the resistance of which varies with the intensity of the light, being about twice as great in the dark as in the daylight; this current is transmitted and at the distant end, by means of a magnet, it moves a prism in front of a strong white light, breaking it up into colors; this revolution will be such as to bring the required color into view; the two mirrors oscillate synchronously; it is claimed that the natural color is reproduced; as the points follow each other with great rapidity, an observer will get an impression of the entire picture. It is claimed to be more difficult to reproduce moving pictures than stationary ones. Those who have seen the apparatus state that the colors are not always clear, and the objects do not remain steady, but are constantly vibrating, but it is thought these defects will be remedied; the apparatus is to be exhibited in Paris in 1900, when it is believed by that writer that the mihor defects will probably be remedied.

PRACTICAL FEATURES OF TELEPHONE WORK. Dobbs. "Elec. Eng.," March 31.—In this continuation of his serial he discusses country and toll lines, describing the systems of crossings to avoid induction.

TELEPHONE STATISTICS.—"Elec. Eng.," March 31.—A short incomplete table for Europe, taken from a consular report.

Miscellaneous.

MANUFACTURE OF PARABOLIC REFLECTORS. Cowper-Cowles. "Jour. Inst. Elec. Eng.," March.—A reprint of his complete paper and the discussion, which was noticed in the "Digest," March 12, 26 and The Electrical World, March 5.

MAKING PARABOLIC REFLECTORS. E. Thomson. Lond. "Elec. Rev.," March 28.—A note stating that a number of years ago he used substantially the same method as was recently described by Cowper-Cowles; it seems to be identical even to the method of removing the deposit from the glass. He adds that the silver deposited on the glass must be as free from pores as possible, as otherwise there is a tendency for the copper plating fluid to pass between the glass and the silver, which causes blisters.

ST. ELMO LIGHT.—"Zeit. fuer Elek.," March 13.—A brief account of an interesting St. Elmo light accompanying a snow storm on February 1, on the Brocken.

DEATH BY ELECTRICITY. Hedley. "Elec. Rev.," March 30.—A reprint of the article noticed in the "Digest," March 12.

Book Review.

THE UNIVERSAL ELECTRICAL DIRECTORY (J. A. Berly's), for 1898, has just been issued by Messrs. H. Alabaster, Gatehouse & Co., London, E. C. It contains the names and addresses of the members of the electrical and kindred industries throughout the world. The British section embraces 9918 distinct names; the American, 4080 names; Continental, 7872; Colonial, 1924, making a total of 23,794 names. Much new and important matter has been incorporated in this year's volume, which makes the directory of additional value to those engaged in international trade. The price is 6s. per copy.

New Form of Enclosed Arc Lamp.

A modification of its enclosed arc lamp has recently been perfected by the General Electric Company, which, while preserving the essential features of its direct and alternating current lamps with enclosed arcs, substitutes a flared porcelain reflector for the outer globe. The mechanism of the lamp is similar to that of the standard enclosed arc lamps, but the use of the reflector instead of the globe allows a large amount of light, which otherwise would be absorbed in the outer globe, to be thrown down by the reflector and thus utilized. Calculating this absorption of light at from 10 to 30 per cent. the single globe lamp allows of the utilization of just so much of the total light from the arc, as well as that which is reflected. In cases in which the direct light from the arc is not objectionable and a general diffusion of the light not absolutely desirable, such as in cafés, hotels, restaurants, etc., the single globe is peculiarly adapted.

In designing the lower part of the frame care has been taken to render it both light and delicate and yet sufficiently rigid to withstand ordinary usage, without interfering to any extent with the passage of the light or casting heavy

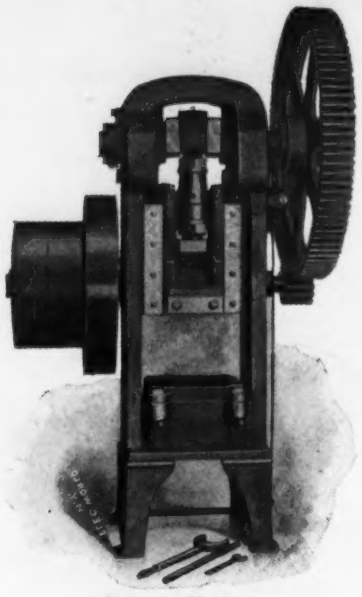
Arc Lamp of New Design.

shadows. It is highly nickeled, and thus, during the day time when the light is not needed the ornamental appearance of the lamp is not detracted from. The inside of the porcelain shade is highly polished, and gives a good reflecting surface. It is interchangeable, and can be used with either direct or alternating globe enclosed arc lamps. By an arrangement of the lower rim of the cover of the mechanism the reflector may be substituted for the outer globe of the double enclosed arc lamps. As in the direct current double globe lamps a simple adjusting coil allows of the use of five, four and a half or four amperes of current. By using a reflector instead of the globe a very satisfactory light may be obtained from this lamp with a current of only four amperes. A reactive coil in the alternating lamps allows of adjustment for any line voltage between 100 and 120 volts and frequencies of sixty and 125 cycles.

The economy in carbons is the same as that obtained in the double-globe lamps, and in addition the lowering of an outer globe is done away with. The globe in which the arc is enclosed is protected by wire netting.

Straight Sided Power Press.

The accompanying illustration represents what is known as a straight sided power press, now being introduced by the E. S. Stiles Press Company, Watertown, N. Y. This press will exert great pressure for given weight because of the adoption of straight lines, thus securing absolute tensile strength of the material. It is built for high duty, and is provided with a high carbon



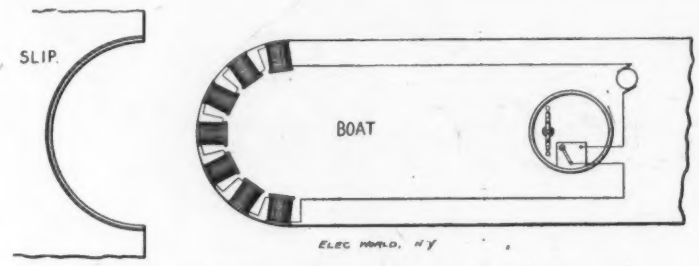
POWER PRESS.

open hearth machine steel shaft, provided with sleeve pitman, with jam nuts. The bearings for the shaft are long, and the support is secured by wedges that are well fitted. They are provided with gears made of high grade cast iron and cut teeth. The pinion is made of machine steel, the teeth of which are closely matched with those of the gear. The standard stroke of the press is 3 inches; standard distance from bed to end of slide, 15 inches; open through bed, 8 inches.

Mooring Boats by Electro-Magnetism.

Hardly a week passes but what some new application of electricity is brought to public notice.

Mr. Harlan P. Wellman, of Catlettsburg, Ky., is the inventor of a method of mooring ferryboats, steamboats, etc., by means of the attractive power of electro-magnets. The most noticeable feature of the method is its simplicity. The accompanying diagram illustrates the purpose of Mr. Wellman's invention very clearly. The curved end of the figure represents one end of a ferryboat, and at the left the ferry dock is represented, with a curved slip for the accommodation of the boat. Around the semi-circular bow Mr. Wellman proposes the use of a series of powerful magnets, connected with one another in series and all with a source of current. The poles of the magnets are flush with the outside surface of the boat. On the bridge, or slip, there is a corresponding set of electro-magnets, but, of course, each having a polarity opposite to that of the corre-



METHOD OF MOORING BOATS ELECTRO-MAGNETICALLY.

sponding magnet on the boat. As the boat enters the slip the magnets are energized by closing the circuit, and their attraction for the magnets on the corresponding surface of the slip serves to hold the boat securely in position.

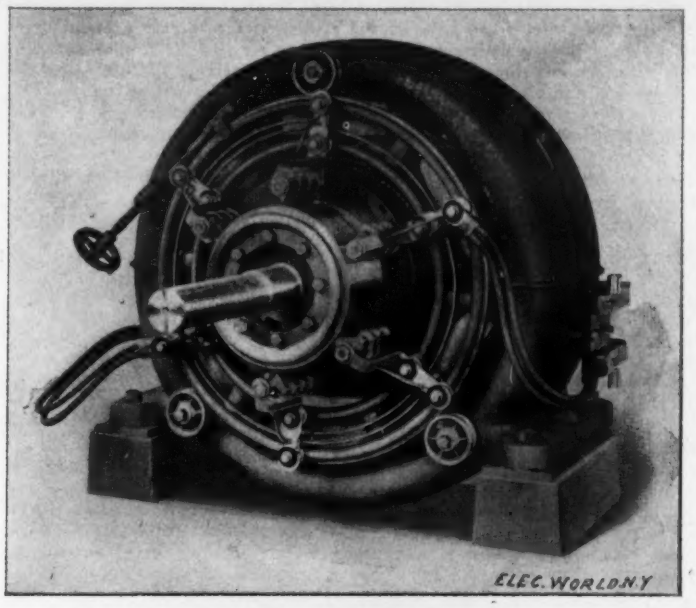
To release the boat from its mooring all that is necessary is to open the circuit.

There are various ways of applying this idea in practice. The magnets on the dock may be energized by the same current that is used in vitalizing those on the boat. This is accomplished by the use of electrodes, one on the surface of the hull and a corresponding one on the dock. On these coming into contact the current passes through both sets of magnets. Another method is to employ only one set of magnets—those on the boat. On the dock plates of a magnetic metal take the place of the electromagnets. The magnets on the boat exert their attractive power inductively upon these metal plates, and thus serve to hold the boat in position.

Mr. Wellman proposes another useful application of his invention, and one which has peculiar interest at this time. The principle may be applied to submarine torpedoes, the idea being that this little engine of destruction shall adhere magnetically to the hull of an ironclad, and keep its position until the favorable time for its explosion shall have arrived.

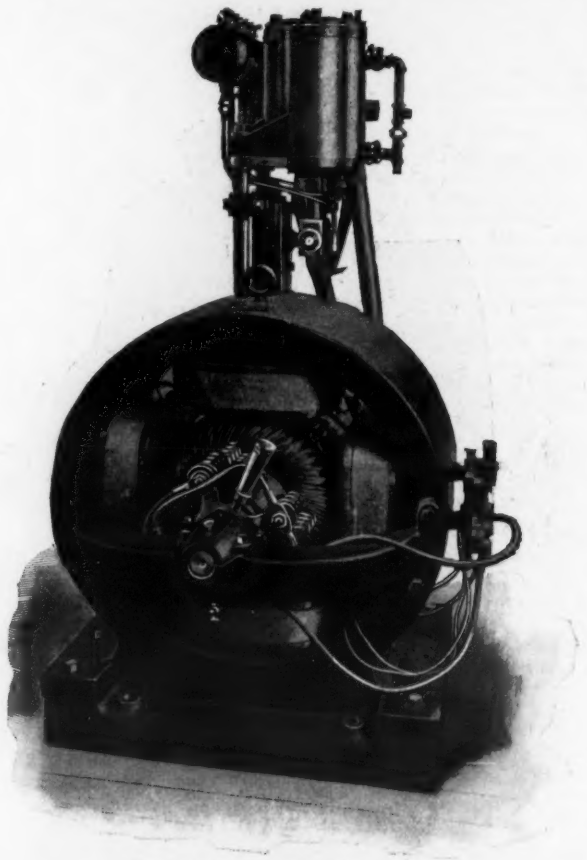
Direct-Connected Generators.

The lower illustration represents a direct-connected generator, manufactured by the Bullock Electric Manufacturing Company, Cincinnati, Ohio.



MULTIPOLAR GENERATOR.

In general design this machine is similar to that of this company's standard multipolar machines. The circular yoke carries inwardly projecting pole pieces of laminated soft steel. The pole pieces are cast welded into the frame, thus forming a more substantial joint, both magnetically and mechanically. This generator is built in six standard sizes, ranging from 25 to 200 kilowatts. These machines are compounded to compensate for drop of potential in the line. The



DIRECT-CONNECTED GENERATOR.

shunt and series coils are wound on separate forms, and are removable at will. The field coils are so wound that they admit of a free circulation of air, thus securing excellent ventilation. The slotted type of armature is used, the windings being held in position by retaining wedges of hard wood driven into the notches near the top of the slot, longitudinally with the armature. This is a feature peculiar to the Bullock machines.

Alternating Fan Motors.

The alternating current fan motor offers a partial solution of the day load problem with which alternating current station managers are inevitably confronted at some time in their experience.

The Emerson Electric Manufacturing Company, St. Louis, Mo., offers to the trade this season some new designs in alternating current fan motors that are worthy of special attention for various reasons, the principal one being the machines are efficient and economical in operation. In this regard the Emerson Company claims that its 1898 models surpass those of the previous year. The desk fans are made in two sizes, 12 and 15 inches, and the ceiling fans in two styles, one with two blades, making from 200 to 210 r. p. m., and designed for sixty-cycle systems, the other, having five blades, making 500 to 600 r. p. m., and designed for high alternations, from 125 to 133 cycles per second.

Fig. 1 gives a rear view of the 12-inch desk fan. The shaft of these motors is pressed firmly into the back cover, and is made of one-half inch bicycle tubing, which is case hardened and ground accurately to size. The armature hub is composed of a larger piece of tubing, into which is pressed at either

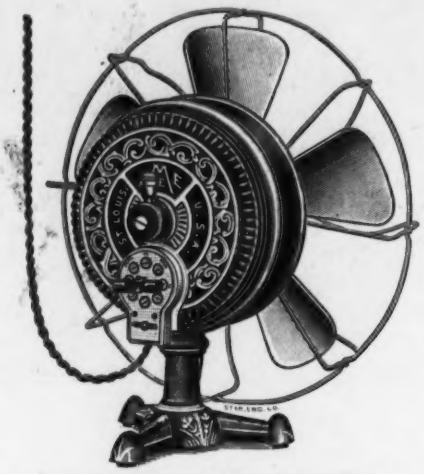


Fig. 1.—Twelve-Inch Desk Fan.

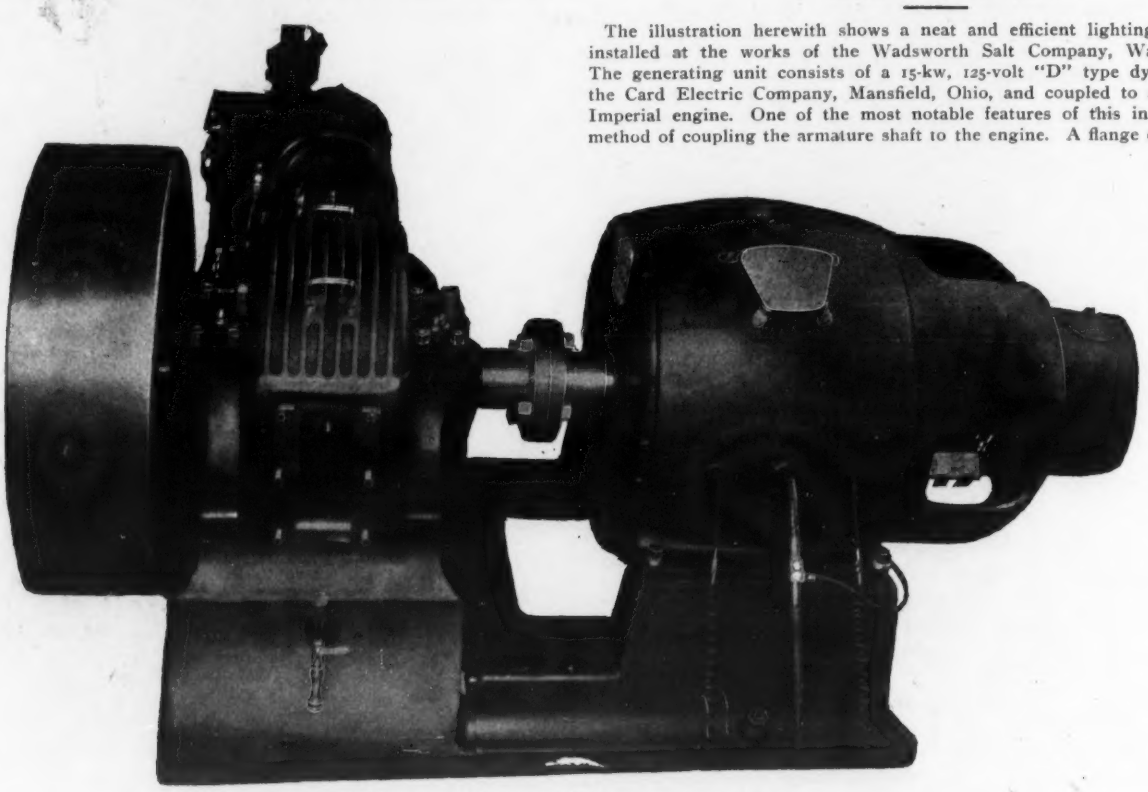
end a brass bushing. This bushing is reamed out accurately to fit the hardened steel shaft, and prevents all rattle and noise. Another improvement lies in the switch plate, which is made of porcelain, the binding posts being insulated, so that it is impossible for anyone to receive a shock in handling the motor. This motor consumes at the start from sixty-five to seventy watts, running at about 1550 r. p. m. By turning the switch over to the position marked "on" the consumption of current is cut down to fifty watts, while the speed remains practically the same. On the "slow" position the current consumption is reduced to about thirty-five watts and the speed to 950 r. p. m. These machines are designed for any voltage and number of alternations.

The five-blade ceiling fan is illustrated in Fig. 2. It is adapted for high alternation systems. It is practically noiseless in operation, the only wearing part being the single ball bearing, which is run in a cup of oil. It requires no attention during the entire season, the oil cup being filled at the beginning. This fan is regularly furnished in black enamel with gold decorations, with hanger and trimmings finished in highly polished and lacquered brass. These fans are furnished with or without lighting fixtures, and they may be made of any length to suit the height of the ceiling. The current consumption while running at the highest speed (210 revolutions) is 125 watts. The second speed, 150 revolutions, cuts the current consumption down to 100 watts. These fans are fully guaranteed in every respect, and the manufacturer claims to have increased the amount of wind given by them from 33 1-3 to 40 per cent. over its last year's fans.

Fig. 2.—Five-Blade Ceiling Fan.

Direct-Coupled Unit.

The illustration herewith shows a neat and efficient lighting plant recently installed at the works of the Wadsworth Salt Company, Wadsworth, Ohio. The generating unit consists of a 15-kw, 125-volt "D" type dynamo, made by the Card Electric Company, Mansfield, Ohio, and coupled to a 7 x 8 Weston Imperial engine. One of the most notable features of this installation is the method of coupling the armature shaft to the engine. A flange coupling is used for this purpose. It permits of quick and easy separation, and is a desirable feature when floor space is not of great moment. The engine and dynamo when first put together made a run of sixteen hours without a stop, hot box or trouble of any kind. The Wadsworth Company is well pleased with its plant, and already contemplates an extension.



A Flange-Coupled Engine and Dynamo.

NEWS OF THE WEEK

Financial Intelligence.

THE EDISON ELECTRIC ILLUMINATING COMPANY, of Brooklyn, has declared a regular dividend of 1½ per cent., payable April 15.

THE GENERAL ELECTRIC COMPANY has, it is reported, since January 1 canceled $2,000,000 more of its debenture bonds, leaving the amount now outstanding slightly under $6,000,000. It is stated that the company is considering a plan to equitably deal with the capital impairment and the accumulated dividends on the preferred stock. Following the adoption of this plan General Electric common stock, it is said, will be placed on a dividend basis.

THE ANNUAL REPORT of the American Bell Telephone Company for the year ended December 31, 1897, was issued on March 29. The statement of earnings and expenses compared with those of the previous year shows the following results.

	1896.		1897.
EARNINGS.			
Rental of instruments	$1 238,378.03		$1,597,959 36
Dividends	2,616,307.00		3,085,379.00
Commission from ex-terr. lines	182,265.32		211,507.21
Commission from telegraph business	34,046.88		33,174.32
Real estate	80,864.38		84,709.85
Interest	171,355.23		117,071.93
Miscellaneous	4,107.41		1,043 25
	$4,327,324 25		$5,130,844 92
EXPENSES.			
Expenses of operation	$490,052.31		$509,314.02
Legal expenses	100,744.78		136,333.49
Real estate	40,117.87		41,560.76
Interest and taxes	303,731.38		273,961.92
Miscellaneous	97.47		.....
	$943,743 81		$961,170.19
Net earnings	$1,383,580.44		$4,169,674.73
Surplus account, December 31, 1896		$2,151,011.61	
Net earnings, 1897		4,169,674.73	$6,320,686.34
Regular dividends, 1897		$2,939,904.00	
Extra dividends, 1897		743,044.50	
Reserve for depreciation of insts		47,216.57	3,730,165.07
Surplus account, December 31, 1897			$2,590,521.27

The ledger balances at the close of 1897 were as follows:

DEBTORS.		
Telephones	$1,772,596.55	
Real estate	1,052,695.92	
Stocks and bonds	52,827,205.59	
Merchandise and machinery	18,319.68	
Bills and accounts receivable	3,275,059.70	
Cash and deposits	1,833,964.11	
CREDITORS.		
Capital stock		$25,886,300.00
Capital stock, premium account		6,110,582.00
Debenture bonds, 1888		2,000,000.00
Bills and accounts payable*		1,216,330.89
Patent account (profit and loss)		12,399,047.16
Profit and loss		6,551,431.94
Reserve		4,025,628.29
Surplus		2,590,521.27
	$60,779,841 55	$60,779,841.55

* Of this amount $1,164,883 50 is for the dividends payable January 15, 1898, to stock holders of record December 31, 1897.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, April 5, 1898.

THE WALKER COMPANY has secured a very commodious suite of offices on the sixteenth floor of the Commercial Cable Building, 18-20 Broad Street. The suite includes a private hall, general offices, private offices for the officials and all the latest conveniences for the transaction of modern business.

THE ELECTRICAL EXHIBITION.—Mr. Thomas A. Edison will exhibit an operative model of his magnetic ore separator at the electrical exhibition to be held in this city next month at Madison Square Garden. The model is being built for him by Mr. Sigmund Bergmann, and will illustrate the fundamental principle of the process of ore separation. A small motor will run the model, and the actual operation of crushing ore and the separation of the iron will be in full view. Samples of crushed rock, as well as samples of the separated ore and of the briquettes which are sent to the furnace, will also be shown. Photographs will illustrate scenes around the mines where the actual work is being carried on by Mr. Edison. The exhibit will be placed along one side of the concert hall of the Garden.

MR. SIGMUND BERGMANN, president of the General Incandescent Arc Light Company, New York, will sail on the steamer "Augusta Victoria" on August 7. Mr. Bergmann's destination will be Berlin, whither he goes on business in connection with his German company.

PROSPERITY OF THE NEW YORK ELECTRICAL SOCIETY.—At the 186th meeting of the New York Electrical Society, which was held in this city on the evening of March 30, fifty-one persons were elected to membership. In the list are the names of several well-known electrical people.

THE MAGNETIC CLUB will celebrate its tenth anniversary on the night of April 13 by a dinner at the St. Denis Hotel, corner Broadway and Eleventh Street. It is intended to make the occasion one of extraordinary interest, and a novel and interesting programme has been arranged for the entertainment of the members and guests. Mr. Richard J. Hutchinson is president of the club this year and Mr. Frank D. Murphy is secretary.

THE METROPOLITAN STREET RAILWAY COMPANY has opened another of its electric conduit lines. On Sunday last, April 3, the Second Avenue line was opened for business. This road runs from 128th Street down Second Avenue to Stuyvesant Street, through which street the line swings westward to Astor Place. At the junction of Fourth Avenue and Astor Place, some of the Second Avenue cars turn southward and run to the Brooklyn Bridge, over the tracks of the Fourth Avenue line, while other cars continue on to the terminus of the line at Astor Place and Broadway, where a transfer is given to the Broadway line. The new cars are equipped with double trucks.

REDUCTION OF BRIDGE CABLE TRAFFIC.—The bridge cable railway has suffered the loss of a great part of its business since the electric cars began crossing that structure. As a consequence of this the operating force has been greatly reduced, and seventy persons have been dismissed from the service. On April 1 forty-three conductors, eight platform men and six power house employees were dismissed. The reduction in the force so far carried out effects a retrenchment in the monthly pay roll of about $5700. On April 1 a new train schedule was inaugurated. Fourteen trains are now operated instead of sixteen, and the headway has been raised from sixty seconds to seventy-five seconds. The trains are now operated wholly by electric power between 8 P. M. and 6 A. M.—that is to say, they are propelled across the bridge by electric power, as well as being switched at the terminals by the same means.

THE ELECTRICAL ENGINEER INSTITUTE OF CORRESPONDENCE INSTRUCTION, the incorporation of which was noted in THE ELECTRICAL WORLD of March 26, has begun active operations. The aims of this institute are to enable anyone desirous of obtaining a thorough knowledge of the electric and allied arts to acquire it by means of carefully prepared printed lesson papers, supplemented by a system of confidential correspondence between the institute and the student. In what respect this institute's plans and methods differ from those of the various similar institutions now in existence in this country we do not know, but it may be accepted as a certainty that they are thorough and complete. The gentlemen who are at the head of the enterprise are well equipped to conduct such an institution. They are well known to the electrical fraternity at large, and possess all the qualities needed to insure success in their work and give satisfaction to the student. The institute is a separate and distinct organization from that of the periodical "The Electrical Engineer," of this city, but is conducted under the auspices of the latter. Mr. Herman A. Strauss, an electrical engineer, is the manager of the institute, and it is said that he is well qualified to fill the important position.

THE EDISON MANUFACTURING COMPANY IN NEW QUARTERS.—The corner storeroom and basement of the St. James Building, Broadway and Twenty-sixth Street, this city, with a total area of over 8000 square feet, has been leased by the Edison Manufacturing Company for use as showrooms of the inventions of Mr. Thomas A. Edison, which the company manufactures. The formal opening of the new quarters took place Saturday evening, April 2. The apparatus put on view in the new rooms is of no little interest, as many pieces of historic value are shown with the latest developments in the same line. For example, the original phonograph with its tin-foil cylinder, massive fly wheel and crude details is shown beside the latest development of the same machine. The original gold and stock ticker and several other of Edison's first models are also shown in the same way. The newer apparatus is so perfect in detail and finish that the contrast is quite striking. Among the other novelties shown are the latest developments of cautery, surgical and medical devices, including the rotary transformers, motor generators and induction coils for obtaining the various currents wanted by the up-to-date fastidious physicians. Another device for similarly unpleasant work is the motor driven dental engine fitted with a pedal controller by which the motor is started by depressing the heel, short-circuited and promptly stopped by pressing the toe and reversed by twisting the foot from side to side. Mr. W. E. Gilmore is general manager of the company, and Mr. J. W. Gladstone manager. They are being congratulated on the handsome appearance of the new quarters.

THE RAPID TRANSIT RAILROAD COMMISSIONERS held a meeting on March 31, at which the committee on contract offered a radical amendment to its report, which was submitted at the meeting of March 19, and outlined in THE ELECTRICAL WORLD of March 26. The committee, it is reported, has reached the conclusion that, in view of the great value of some of the franchises, especially the City Hall branch, crossing Broadway and the West

Street line, it was the opinion of its members that the Manhattan Railway Company ought not to be at liberty to accept such franchises separately upon the terms now proposed for them unless the city shall at the same time secure the relief proposed by the other franchises. The terms of the franchises most attractive to the Manhattan Railway Company have been made easy in the hope that the company will also undertake those it may deem to be less attractive. The board should, however, be prepared to consider the grant upon proper terms to the Manhattan Railway Company of any one or more of the franchises now proposed without requiring the acceptance of others. If any of the seven franchises be rejected, the board, upon learning from the Manhattan Railway Company which of them it is willing to accept, should promptly notify the company what changes are proposed in the terms of the franchise or franchises to be accepted, in view of the unwillingness of the company to undertake a more general treatment of the problem. No action was taken upon this report. Forms for the seven proposed franchises were offered for action, but Comptroller Coler declined to vote upon them, for the same reasons given for his refusal to vote at the meeting of March 22. Action was thus blocked. The contract committee presented a report regarding the proposed contract for building the underground road, and with a form for the proposed contract. The report was referred to the corporation counsel. The report declares that the contract requires a deposit to be made by the contractor of $1,000,000 in cash, the filing of a continuing bond for $1,000,000 and the making of the bond of $14,000,000 to cover the period of construction and equipment. The lease of the road is to be for fifty years, and the rental equal to the interest paid by the city on the cost of the road, an additional percentage for a sinking fund and a further payment of 2½ per cent. on the excess gross earnings in any one year over $5,000,000. Work is to be begun within thirty days after the execution of the contract, and the road is to be finished within four years. The right of the city to use the tunnels for police and fire telegraphs and other municipal uses is reserved.

SOME WEEKS AGO the president of the Grand Street Crosstown line was authorized by the board of directors to employ an expert engineer to make an examination of the storage battery line now operating in Chicago. This examination was made, with the result that such a favorable report was presented that the directors further authorized the equipment of a small electrical plant at their car barn, and the operation of at least two storage battery cars for a sufficient length of time to determine whether or not the conditions under which the cars would be required to operate in this city would cause an increase in the cost of operation and maintenance over that obtained on the Chicago road. Four cars were leased from the Chicago Electric Traction Company (formerly the Englewood & Chicago Electric Street Railway Company), together with the batteries and other equipment necessary for the operation. An elevator and a 90-hp direct-connected Westinghouse gas engine unit were installed at the Grand Street car barn, and for over 30 days past two of the cars have been in regular operation, making from 90 to 95 miles per day each. On account of the poor condition of the track, bad joints and worn-out curves, the operation of the cars has been attended with a much larger expenditure of energy than would have been the case if the road had been in first-class condition. Another factor would militate against economical operation, viz., the motors being designed for a normal speed of 16 miles per hour, whereas the speed at which they are now operating on Grand Street is only 6 miles per hour. These motors are designed principally for long high-speed runs, such as occur in suburban operation, and therefore are at a disadvantage when run at a slow speed, combined with continual stopping. Even under these unfavorable conditions the power consumed has been very satisfactory, as the average energy recorded at the switchboard is 1.94-kw hours per car mile during the period from March 14 to March 26 inclusive. It is assumed that under favorable conditions of track and motor the actual operation could be reduced to not over 80 per cent. of the above figure, or 1.55-kw hours per car mile. This would give on the car an expenditure of considerably less than an electrical hp hour per car mile. Under the circumstances all concerned feel very well satisfied with the operation of the cars. As the cars have demonstrated all that was necessary they will shortly be withdrawn.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Build'ng, 620 Atlantic Ave.,
BOSTON, Mass., April 2, 1898

THE C & C ELECTRIC COMPANY'S Boston office has been removed from 63 Oliver Street to more modern and commodious quarters at 19 High Street, corner of Federal. The company's customers will be welcomed at the new offices by Mr. William F. Palmer, who has recently succeeded Mr. H. A. Howard as the New England manager.

THE SWETT & LEWIS COMPANY, Boston, has purchased of the Stanley Dry Plate Company, Newton, Mass., its static machine parts and supplies, which makes a most valuable acquisition to the already admittedly efficient lines of X-ray specialties of the Swett & Lewis Company, the business of which has grown to quite a large magnitude. The Swett & Lewis Company is just issuing new catalogues on static machines, Crookes tubes and fluoroscopes, copies of which will be gladly furnished upon application.

THE BELKNAP MOTOR COMPANY, Portland, Me., is very busy. Orders and inquiries regarding the new types of Chapman voltage regulators are coming in rapidly, and its general business is exceptionally good. General Manager Brown is untiring in activity and effort to take care of the increased business and also to extend it. The Belknap Motor Company will have an excellent exhibit at the forthcoming electrical exhibition in New York, and also at the exhibition of the Massachusetts Charitable Mechanics' Association in Boston, next October.

THE HOLTZER-CABOT ELECTRIC COMPANY, Brookline, Mass., is distributing its 1898 "Fan Motor" catalogue, a neat and concise edition, and presenting in an attractive manner and detail its various types of direct-current fans. The catalogue announces that the 16-inch fan has been remodelled, and is of the same form as the 12-inch, being compact in design, symmetrical and pleasing to the eye. The principal features of the fan motors of this company are spherical bodies, laminated fields and armatures, self-feeding carbon brushes, four-speed switches, working parts enclosed in the base, and so not liable to injury; use of grease cups instead of oil as a lubricant, unsurpassed for efficiency, the current consumption being exceptionally low for the air moved; running under full load quietly and noiselessly, economical, strong and durable.

THE "ELECTRIC POTENTIAL" CLUB, Boston, met at Young's Hotel last Friday evening, April 1, for dinner and to listen to a very able description of "Electricity in Its Application to Sea Coast Defense," by Lieut. John Stephen Sewell, Corps of Engineers, U. S. A., which was illustrated by stereopticon. Lieutenant Sewell's remarks were extemporaneous, and his thorough knowledge of electricity in sea coast defense commanded for him the closest attention. Lieutenant Sewell answered many interesting questions propounded by members, but present conditions with relation to Spain prevented answers to all inquiries. General Bancroft, who was present, also made some pleasant remarks. The last picture thrown upon the canvas was "Old Glory," and the members rose and sang one verse of "The Star Spangled Banner," accompanied by a cornet. A vote of thanks was extended to Lieutenant Sewell. About fifty members were present, and all felt that the meeting was one of the most enjoyable of the many since the organization of the club.

PHILADELPHIA NOTE.

Branch Office of THE ELECTRICAL WORLD,
929 Chestnut Street,
PHILADELPHIA, Pa., April 4, 1898.

THE FIRM OF TAYLOR & CLARK, dealers in electrical supplies, this city, has been dissolved by mutual consent. The members of the firm were Joseph P. Taylor and Louis P. Clark. Mr. Clark has purchased Mr. Taylor's interest, and will continue the business at 510 Arch Street, under the firm name of L. P. Clark & Co.

SOUTHERN NOTES.

WASHINGTON, D. C., April 4, 1898.

TWO BILLS have been introduced in the Maryland House of Representatives relative to telephone companies. One repeals the act by which the companies are permitted to make extra charges for improved service, as recommended by the commission of 1894, and the other prohibits any telephone company from charging a rental of more than $5 a month per telephone when the instrument is used within a radius of 3 miles from the exchange. Outside of this limit the rental is to be $1 additional per mile per month.

A BILL has passed the House of Representatives providing that every street railway operated within the District of Columbia shall pay a franchise tax of five-eighths of 1 per cent. per annum of its gross earnings. The Capital Traction Company, the Metropolitan Railroad Company and the Columbia Railway Company each is required to pay in addition to the franchise tax an annual tax of 4 per cent. on its gross earnings. All other railway companies in the district are taxed 2 per cent. on their gross earnings in addition to the franchise tax.

BIDS WERE OPENED at the Signal Office of the War Department on Friday last for furnishing insulated wire to the Government for use in connecting the Government forts in the vicinity of the capital. The specifications called for bids on wire Nos. 12, 14, 16 and 18, in 20-mile lots. The following named concerns tendered bids: The Okonite Company, New York; the Safety Insulated Wire & Cable Company, New York; the Simplex Electrical Company, Boston; Western Electric Company, New York; James H. Collender, New York, and James S. Barron & Co., New York.

BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., April 2, 1898.

THE NEW TROLLEY LINE to run from Hamburg to Morton's Corners as a connection of the Buffalo, Hamburg & Aurora road is to be extended 6 miles further to Collins. Bids for the work on the latter line were opened here this week in the office of President U. L. Upson. It is expected that work will begin this month.

THE NEW WORKS of the Acetylene Light, Heat & Power Company, at Niagara Falls, were sold on a chattel mortgage on March 28 for $85,000. The purchaser was the Electro Gas Company, of New York. As this is the parent company the business will not be allowed to stand still long, and it is expected that some enlargement and improvement will be made.

BUFFALO IS NOT PLEASED over the failure of the Legislature to grant the necessary permits to the new telephone companies which were projected for establishment here. The present telephone charges are too high. For some reason the measure providing for competition was not pushed, and the contest in committee, if such a stage was ever reached, was such a quiet affair that it never reached the Buffalo public ear.

THE ELECTION OF OFFICERS of the Buffalo Valley Railway Company took place this week with the following result: President, Edgar C. Felton; vice-president, Mason D. Pratt; secretary and treasurer, Felton Bent; chief engineer, George A. Ricker. Mr. Felton is president and Mr. Pratt engineer of the Pennsylvania Steel Company, of Steelton, Pa., and Mr. Bent is the manager of the Harrisburg Traction Company. The survey is just finished, and to secure the right of way will no doubt take about three months. Mr. Ricker, who is at the head of the local interest in the line, is chief engineer as well of the Buffalo Traction Company and the Niagara Gorge road.

CHICAGO NOTES.

Branch Office of THE ELECTRICAL WORLD,
986 Monadnock Building,
CHICAGO, Ill., April 2, 1898

THE WESTERN TELEPHONE CONSTRUCTION COMPANY, Chicago, writes to the effect that the Firman patent referred to in a recently published statement does not, in any manner whatsoever, affect the multiple transfer system of the switchboard of that company. The statement above referred to, the Western Telephone Construction Company says, indicates by inference that the Firman patent covers all forms of multiple switchboards, and that the pat-

ent was upheld in favor of the Western Electric Company in a recent California suit. The Western Telephone Construction Company challenges a single particular in which the Firman patent claims refer to its devices.

PREPARATIONS ARE BEING MADE by city officials to prosecute the street car companies for failure to comply with the provisions of the fender ordinance within the prescribed time. The ordinance was passed September 27, 1897, and went into effect ninety days later, but was subsequently extended sixty days in order to give the companies more time to equip their cars with safety appliances. Little or no attention has been paid to the ordinance, and the corporations have been served with notices several times to the effect that unless they obeyed the requirements they would be prosecuted. It is stated that not a single road has complied with the ordinance. The penalty for violations is a fine of from $10 to $50 a car for every day cars are operated contrary to the provisions of the measure. The street railway companies have not intimated in any way what they propose to do in the matter. It is probable, however, that they will take the position that sufficient protection is afforded by the wheel guards now in use.

ST. LOUIS NOTES.

ST. LOUIS, April 1, 1898.

THE CENTRAL TRACTION bill has been passed by the Municipal Assembly, and will be sent to the mayor for his signature.

THE STANDARD TELEPHONE COMPANY, now constructing a line from Kansas City to St. Louis, via Sedalia, will be operated from Sedalia in connection with the Russell Long Distance Telephone Company.

ALL OF THAT PART of the St. Louis & Kirkwood Electric Road between Kirkwood and Meramec Highlands is being double tracked as rapidly as possible. The work of laying the second track will be completed probably within the next ten days.

THE SUPREME COURT decided Tuesday that the president of the Council would have to sign the North and South bill, introduced in the Assembly last summer, and which he refused to sign on the ground that it had not been regularly passed. The court sustained the decision of the Court of Appeals, to the effect that the duties of the president of the Council were entirely ministerial and not discretionary. The judge of the Circuit Court who passed on the case first and upheld the action of President Meier was overruled.

THE GENERAL ELECTRIC COMPANY has secured the contract for the electrical equipment for the building erected on Washington Avenue in St. Louis, Mo., for the Commerce Realty Company. The contract includes three compound Imperial engines of 120 horse-power each, direct connected to three 75-kw direct-current dynamos running at 260 revolutions. There will be about 600 16-cp incandescent lamps throughout the building and 200 long burning enclosed arc lamps. The entire elevator plant will also be operated by electric power supplied from the same generating plant. The contract for the elevators has been awarded to the Sprague Electric Company, New York. It includes two passenger elevators, six freight elevators, one dumb waiter and one ash hoist. The distribution will be on the 220-volt two-wire system for the different kinds of service. The elevators are to be run on the same generator units as the lighting system. This installation represents a distinct advance in St. Louis in modern equipments of this character, and its performance will be watched with interest. Messrs. Bryan & Humphrey, of St. Louis, are the consulting engineers. The steam equipment includes three 150-hp water tube boilers, with down-draft furnace, Paul system of steam heating, two Hoppes feed water heaters, boiler feed pumps and a complete system of pipe work. Steam will be carried at 125 pounds pressure.

TEXAS NOTES.

SAN ANTONIO, Tex., March 28, 1898

THE ARMY GARRISON and new harbor defense works at Galveston Island are being fitted up with electric lights and necessary electrical appliances for the handling of the big guns.

MESSRS. W. G. SCHUWIRTH & CO., San Antonio, are putting in a new electric light plant at Beeville, Tex. They will own and operate the plant, and furnish lights to the city as well as to private customers.

THE STREET RAILWAY STRIKE at Houston is still unsettled, and there is no immediate prospect of traffic being resumed to its full extent on any of the lines of that city. The strikers are threatening, and obstruct the efforts of the company to operate the cars. On March 27 a riot between the strikers and the new men was only averted by the timely arrival of a local militia company at the scene of trouble.

THE AUSTIN DAM AND SUBURBAN STREET RAILWAY has changed hands, the new owners being Austin and New York City capitalists. It is reported that Mr. Collis P. Huntington, the railway magnate, is a heavy stockholder. It is an electric line, and it is announced that extensive improvements and extensions of track will be made. The new officers are as follows: Mr. A. N. Leitnaker, president and general manager; Mr. Carlf F. Drake, vice-president; Mr. John H. Chiles, treasurer; Mr. George A. Hill, secretary.

MEXICAN NOTES.

MONTEREY, Mexico, March 28, 1898.

A NEW ELECTRIC LIGHT PLANT has just been installed at Puente de Ixtla, State of Guerrero. The work was in charge of Mr. Clem Evans, an electrician of the city of Mexico.

IT IS STATED that owing to the many orders for private lighting which have been received recently by the Mexican Gas & Electric Light Company, of the city of Mexico, the manager, Mr. S. B. Knight, has been compelled to order a new 5000-light generator from the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa., to meet the demands.

MR. H. A. BUTTERS, of San Francisco, Cal., the new manager of the extensive Federal District Street Railway Company's lines in the city of Mexico, has arrived at the latter city to assume his new duties. Mr. Butters is a member of the English syndicate that purchased that system three years ago, and it was principally through his efforts that the transaction was consummated. Mr. Butters came to the city of Mexico almost direct from Geneva, Switzerland, where he spent the past six months. He obtained a concession for an extensive street railway system in Geneva in behalf of his syndicate. Mr. Butters states that he will give immediate attention to the matter of equipping the city of Mexico system with electric motive power.

PACIFIC COAST NOTES.

SAN FRANCISCO, Cal., March 26, 1898.

MR. C. M. WILKINS, of Partrick, Carter & Wilkins, Philadelphia, is in San Francisco in the interests of his firm.

VENTURA, CAL., wishes to issue forty-year city bonds to the extent of $20,000, for the purpose of installing a new electric lighting plant.

THE STAYTON (OREGON) TELEPHONE COMPANY has been incorporated by G. B. Trask, A. L. Shreve and E. E. Porter; capital stock, $150.

THE PACIFIC COAST ELECTRIC COMPANY, Mr. T. M. Crane manager, recently inaugurated the renewing of incandescent lamps on the Pacific Coast at its factory in the Bancroft History Building, San Francisco. Large quantities of lamps for renewal have been offered, and prospects for such business are favorable.

MR. T. S. BULLOCK, who is interested with the California Exploration Company people, has applied for the necessary franchises through the counties that would have to be traversed by a pole line to reach San Francisco. Calaveras County has already granted the desired franchise. The Blue Water Company will sell water to the company that will spend the money necessary to perform the hydraulic and electric engineering.

THE GENERAL ELECTRIC COMPANY'S Pacific Coast district agency, having its head office in San Francisco, reports general business very good. River steamer and steamship lighting plants for the Alaska transportation lines have created a demand for several carloads of generators, many of the contracts being filled through the Portland, Ore., and Seattle, Wash., offices. The company recently received the contract for a 10-kw generator for the Yukon River revenue cutter built here by William Birch & Co.

PLANS HAVE BEEN PREPARED for a lively opposition electric light system for the Mission district of this city, the steam plant of which is to be located near the corner of Seventeenth and Harrison Streets. It is proposed to lay the first section of conduit in Sixteenth Street, between Sanchez and Harrison Streets, and to make extensions up and down Mission Street. J. W. McDonald, president of the City Street Improvement Company, has filed the necessary bond to insure permission to excavate for conduits.

THE ROCKY MOUNTAIN BELL TELEPHONE COMPANY will soon close the gap in the territory between Herron, Mont., and Mullan, Idaho, the distance being 125 miles. There will then be a continuous telephone line from the Pacific Coast to Livingston, Mont. Roughly estimated, the distance that can be covered will be San Diego, Cal., to Spokane, Wash., via Sunset Telephone lines, 2200 miles; Spokane to Livingston, 500 miles, a total of about 2700 miles, the longest in the world.

A NEW KAWEAH RIVER water power electric transmission is likely to be installed successfully to operate electric lights and waterworks in Visalia, Cal. Messrs. W. H. Hammond and A. G. Wishon are interested in forming a company to take water out of the river, 30 miles from Visalia. A branch line from the power house would supply Porterville in time, the latter transmission being 44 miles in length and requiring a tension of 20,000 volts. A 1600-hp plant has been figured on, to begin with. It is expected that the Kaweah Power & Water Co. will not build its contemplated plant, but will purchase power from the new company.

THE MUTUAL ELECTRIC LIGHT COMPANY, San Francisco, recently made the city a formal offer to duplicate in every way the present electric street lighting service at a reduction of $40,000 per annum on the amount charged by the San Francisco Gas & Electric Company, under its contract, which will expire next August. The lighting of public buildings would also be included under the proposed reduction. The city has been for some time past lighted by a combination gas and electric system, at an annual expense of $300,000. There has usually been a deficit in the lighting fund before the end of the fiscal year, leaving the city without a right to lights for several weeks. To avoid this there will be ten nights per month without lights from this month until June 30.

THE YUBA POWER COMPANY'S Brown's Valley electric power station went into operation March 21, lighting Marysville, 23 miles distant. Three 500-hp Stanley two-phase generators are directly connected with Pelton wheels, operated under an effective head of 293 feet of water. The present capacity of the plant is 1876 horse-power, and the loss is figured at 8 per cent. of its maximum capacity. Mr. John Martin, of San Francisco, is interested in the company. The construction record for electric transmission plants in California was broken by the contractors on this system. Work was begun last November, and it has been completed considerably within the estimated time. Beside supplying the mining works of Brown's Valley with power the company proposes to extend the system to Wheatland, Smartsville, Woodland, Lincoln and other towns.

ENGLISH NOTES.

(From Our Own Correspondent.)

LONDON, March 23, 1898.

FREE WIRING.—The House-to-House Electric Light Company, which supplies current over a large area in the West End of London, has recently adopted an ingenious and very successful method of inducing small consumers to adopt the electric light. This consists of putting in, free of cost, an installation of six 16-cp glow lamps with fittings and everything complete, the consumer paying for current at the usual rate of 6d. per kilowatt hour, together with a meter

rental of 2s. per quarter, the consumer agreeing to pay not less than 1s. per lamp quarter. All that is stipulated is that the consumer shall purchase the installation at a cost of not more than £6 in the event of his requiring to extend it, and further that unless his tenancy will extend for more than two years beyond the date of the contract the landlord shall agree to take over the installation in the event of the consumer leaving the premises. It is possible that some such system might commend itself to American electric light companies.

TORQUAY ELECTRIC SUPPLY WORKS.—The Torquay municipal electric supply works were opened a few days ago by the Mayor of Torquay. The system adopted at these works is the alternate current high pressure system, with Ferranti rectifiers for the street arc lightning. The generating station is situated in a number of arches close to the shore and in the neighborhood of the residential district. In order to obviate vibration the rock foundation has been excavated to a considerable depth, and replaced by concrete, with hair felt separating the concrete from the rock. The plant consists of Babcock-Wilcox boilers, and three sets, consisting each of a 225-hp Willans compound condensing engine, direct coupled to a 125-kw Fynn alternator. This latter develops from 2000 to 2200 volts, with a frequency of alternation of fifty cycles per second. The mains are on the concentric system, with the outer conductor earthed, and are laid in timber conduits filled in with insulating compound. Already some 3600 lamps have been connected, in addition to the street lamps, so that the station starts with a very satisfactory load. I may mention that the plant, mains, sub-stations, etc., have cost up to the present the sum of £23,400.

French Notes.

(From Our Own Correspondent.)

PARIS, March 18, 1898.

TELEPHONE LINE BETWEEN PARIS AND BORDEAUX.—Since February 26 the second telephone circuit between Paris and Bordeaux has been in service. The length of the new line falling short of 600 kilometres (372 miles) the tariff for five minutes' conversation has been reduced to 3 francs (60 cents). On the date mentioned above telephone lines between Bordeaux and points in the departments of the Landes and Basses-Pyrenees were also opened.

ELECTRIC FOUNTAINS AT PARIS.—The two fine fountains in the Place de la Concorde and those which mark the entrance to the Avenue de l'Opéra, Place du Théâtre Francais, have just been fitted with lamps transforming them into luminous fountains. The latest trials have plainly shown that it is sufficient for good results to put at the bottom of the fountain basins water-tight boxes with glazed openings containing a number of groups of incandescent lamps. The coverings of these foci of illumination, representing 1200 candle power for the Place du Théâtre Francais and 2000 candle power for the Place de la Concorde, are very lightly tinted with a golden yellow. This is the only color used, and it gives to the fountains illuminated by it the appearance of cascades of diamonds and topazes lit by a summer sun. Soon promenaders can enjoy in the evenings this beautiful sight at the entrance of the Avenue de l'Opéra and in the Champs Elysées.

SCHOOL OF MILITARY TELEGRAPHY.—On March 1 a school of military telegraphy was formed at the fortress of Mont Valerien for the instruction of the military telegraphers of the engineers, of which the corps forms a battalion of six companies. The soldiers of this corps will be occupied exclusively with telegraphy, from this date, in fortified places. They will be engaged not alone upon the working of the optical signals, which naturally devolves upon them, but also in the working of the electrical installations at such posts as are provided with them, and which have heretofore been under the care of the artillery personnel. On account, however, of the practical restriction of the telegraphers to the engineer troops now maintained in France, the service of the electric installations will be performed by the engineers only in the forts of the line of defenses for Verdun, Toul, Epinal, Belfort, Briancon and Nice, and possibly in those for the defense of Grenoble. The artillery will take care of the other installations pending the coming of the new order of things.

STATISTICS OF ELECTRIC LIGHTING IN PARIS.—The seven electricity supply stations in Paris are divided as follows: The Secteur Edison feeds 70,000 lamps, the Secteur Eclairage et Force 60,000, the Secteur de la Place Clichy 85,000, the Secteur de l'Air Comprimé 55,000, the Secteur des Champs Elysées 80,000, the Secteur Municipale 6000, and the Secteur de la Rive Gauche 60,000, a total of 416,000 lamps, to which should be added 286,000 lamps fed by special installations as follows: Municipal installation at the Hôtel de Ville (City Hall), 5400 lamps, the Bercy wine warehouse 990, abattoirs 600, railway stations 13,000, stores 8000, large hotels 8000; miscellaneous, 240,000. Allowing an average consumption of three watts per candle-power a 10-cp lamp will consume in a year thirty watt hours. At the price of 10 centimes per hektowatt hour (20 cents a kilowatt hour) the expense would then be 3 centimes (0.6 cent) per lamp hour, or 0.06 cent per candle-power hour. This is exactly the price of gas. In Paris the actual prices per hektowatt hour for current range between 12.69 centimes (2.54 cents) and 9.66 centimes (1.92 cents). In the provinces the highest price, 15 centimes, is charged at Angoulême and the lowest at Havre, where the rate is 8 centimes.

TRAMWAY OF THE COTE STE. MARIE AT HAVRE.—The new line of electric tramway connecting the city of Havre with the Ste. Marie Cemetery and the Quartier des Acacias is one of the last opened to the public, and presents some interesting details. The line is only 750 metres (2440 feet) long. The starting point is at an altitude of 12.85 metres and the end of the line at 82.39 metres, a difference of 69.54 metres (227 feet), and giving a mean grade of 9.2 per cent. The exploitation of this line was attempted in 1895, using two automobile cars of the superheated steam variety, attached together by a cable going over a pulley at the top of the hill, but the system presented such troublesome disadvantages that it was abandoned after a few weeks' use. Electric traction using the trolley system was substituted for this remarkable arrangement by the French Thomson-Houston Company, the rolling stock comprising four motor cars, each seating fifty passengers. Each car is equipped with two motors, giving a total of 100 horse-power. Brakes were, of course, an object of special study, and three kinds are provided, each capable of stopping the car. They are a magnetic brake; a four-shoe brake manipulated by an endless screw capable of developing enormous power, and a track brake also operated by an endless screw of great power, capable of lifting the car from the track until its whole weight rests on the "skates" of the brake. In addition to these, two ratchets are operated from either platform, and avoid any tendency for an ascending car to start down hill should the current be broken from any cause or a fuse blow. Since they allow all the other brakes to be taken off while the car is at rest they also greatly facilitate starting. Current at 550 volts is used, furnished from the station of a local electric light company. The current strength varies between 90 and 140 amperes, and the cars do their work well and without undue wear.

A LARGE POWER-TRANSMISSION PLANT.—Lyons, having a population of 400,000 inhabitants, is an important industrial city, employing in 1892 no less than 13,000 horse-power for dyeing, sizing and printing fabrics, spinning, weaving, etc. To further develop the weaving industry a company has been formed to utilize the power of the falls of the Rhône. The project, which is now in course of execution, consists of the establishment of a canal begining at a point 15 kilometres (9.3 miles) up stream to Cussey-Villeurbonne, where the power station is to be located, and thence to return the water to the river through a canal 2 miles long. The fall thus established is nearly 40 feet at low water, and gives a total output of 20,000 horse-power. The station is to contain sixteen of Escher, Wyss & Co.'s turbines of 1250 horse-power each, operating dynamos, and three turbines of 250 horse-power each working the exciters. The dynamos will be of the vertical shaft pattern, made by Brown, Boveri & Co., and will work at 120 r. p. m., furnishing three-phase current at 3500 volts and fifty cycles per second. This rather high tension has been decided upon on account of the distance of the station from the centre of the city, nearly 4½ miles. For the simplification of the service only a single reduction of voltage by stationary transformers is attempted. The secondary system is supplied by feeders at 115 volts. The high tension cables consist of three conductors, thoroughly insulated and lightly spiralled together, and every precaution has been taken to avoid losses and short circuits. The cables are buried in a trench between two protecting layers of sand, and further protected by a course of bricks against external injury. Small buildings protect the apparatus for transformation and for the handling and connection of the secondary system. Similar buildings contain the switches connecting the feeders and the high-tension distribution circuits.

ELECTRIC EXPLOSIONS OF FIRE DAMP.—For two years MM. H. Couriot and J. Meunier have been conducting an investigation of the explosion of mixtures of air and fire damp by electricity, and have just submitted their results to the Académie des Sciences. The employment of electricity in collieries becoming daily more extended, both for lighting and the transmission of power to the headings of the mine, it becomes of the greatest interest from both a scientific and a practical point of view to know the effects of electrical phenomena upon explosive mixtures of mine gases. There are three sorts of electrical phenomena that can exercise an effect upon explosive mixtures: 1, the incandescence of a conducting wire; 2, sparks, especially the spark of rupture of a circuit; 3, the voltaic arc playing between carbon electrodes. MM. Couriot and Meunier have particularly studied the first two of these phenomena. Fire damp may be considered as a gaseous current or in the form of a stagnant mixture. Fire damp in motion.—We have found it impossible, say MM. Couriot and Meunier, to ignite a stream of fire damp containing 80 per cent. of methane by projecting it upon a metallic wire brought to incandescence by an electric current, or by the spark of rupture due to the melting of the circuit wire. This same experiment repeated upon illuminating gas results in its instant ignition. There seems to be, on this account, an essential difference between the two gases. Contact with a flame is necessary for the ignition of fire damp. For these reasons it is needless to consider the case of fire damp in motion. Fire damp in a stagnant condition.—Experiments were made upon the gas under a receiver. A wire traversing the gas is raised to incandescence by a current of electricity. The results noted may be given under three heads: 1, electricity can cause no other effect upon fire damp than an explosion; 2, metallic wires brought to incandescence by a current of electricity are powerless to ignite even the most explosive mixtures; 3, the explosion, if one take place, is caused only by the spark of rupture due to the breaking of the incandescent conductor. It is not necessary that the broken wire should first be brought to incandescence, as the experimenters exploded the gases by the rupture of ordinary fuse wire melting at about 300 C. In conclusion, the explosion being due only to the rupture of the current, it is to be noted that the sparks that frequently appeared between the incandescent conductor and the metallic wires that held it were not able to start one.

General News.

New Incorporations.

THE KIBBIE TELEPHONE COMPANY, Kibbie, Mich., has been organized with a capital stock of $10,000.

THE FARMERS' TELEPHONE COMPANY, Petersburg, Ind., has been incorporated with a capital stock of $5000.

THE M. B. WHEELER ELECTRIC COMPANY, Grand Rapids, Mich., has been formed with a capital stock of $25,000.

THE FLOWER CITY TELEGRAPH & STOCK COMPANY, Rochester, N. Y., has been incorporated with a capital stock of $10,000.

THE JORDAN, ELBRIDGE & SKANEATELES HEAT & LIGHT COMPANY, Jordan, N. Y., has been formed with a capital stock of $25,000.

THE CITIZENS ELECTRIC RAILWAY, LIGHT & POWER COMPANY, Jordan, N. Y., has been formed with a capital stock of $25,000.

THE CITY TELEPHONE COMPANY, New York City, N. Y., has been incorporated at Albany with a capital stock of $100,000, for the purpose of operating a telegraph and telephone system in New York City and to Albany and Boston and the intermediate places in New York, Massachusetts, Rhode Island and Connecticut; also on Long Island to Montauk Point, and to Jersey City

and Philadelphia and the intermediate places between the same. The directors are Thomas D. Bowen, Frederick D. Britton, William F. Chester and Jacob Schwartz, New York City; John H. Hingle, Rutherford, N. J.; William J. Kelley, of Jersey City, and William J. Scott, Port Richmond.

THE ILLINOIS ELECTRIC COMPANY has been incorporated at Chicago, Ill., with a capital stock of $80,000, by F. E. Healey, L. K. Cushing and Carl Keith.

THE EASTERN TELEPHONE COMPANY, Enfield, Me., has been incorporated with a capital stock of $2000. Samuel W. Bragg is president and Michael S. Fahey treasurer.

THE STUTTGART WATER & ELECTRIC COMPANY, Stuttgart, Ark., has been incorporated with a capital stock of $10,000. The incorporators are Charles Williamson, Joseph Parks and B. P. Williamson.

THE TUPPER LAKE TELEPHONE COMPANY, Tupper Lake, N. Y., has been organized with a capital stock of $1000. Among those interested are N. L. Johnson, William McLaughlin and others of Altamont.

THE JERSEY CITY ELECTRICAL CONSTRUCTION COMPANY, Jersey City, N. J., has been formed by H. C. Newton and T. H. Simonson, of Paterson, and J. McCullough, of Jersey City, with a capital stock of $10,000.

THE CARBONDALE LIGHT, HEAT & POWER COMPANY, Carbondale, Pa., has been formed with a capital stock of $100,000. The incorporators are E. E. Spencer, J. L. Connell, E. H. Ripple, T. J. Moore, John Burnett, M. P. Flynn and T. J. Kelly.

THE BOLTON FALLS ELECTRIC COMPANY, Bradford, Vt., has been incorporated with a capital stock of $75,000. The company controls the water privilege of Bolton Falls, and will build a plant to supply Waterbury with electricity for power and lighting.

THE CO-OPERATIVE TELEPHONE COMPANY, Madison, Ohio, has been incorporated for the purpose of building telephone lines. The incorporators are H. W. Billingston, W. B. Wheeler, G. H. Kellogg, E. J. Williams, L. A. Foster, B. A. Barr, D. B. McMackin and F. A. Martin.

THE CITIZENS ELECTRIC LIGHT & POWER COMPANY, of Gonzales, Tex., has been organized and charter filed with the Secretary of State. The company has a capital stock of $5000. The seven directors are: W. M. Fly, August Klein, Jr., W. E. Houston, J. P. Randle, L. Brenner, Charles Beringer, J. D. Sayers, Jr., all residents of Gonzales.

THE NEW AMSTERDAM TELEGRAPH & TELEPHONE COMPANY has been incorporated at Albany, N. Y., with a capital stock of $100,000, to operate in the several boroughs of New York City. The directors are H. W. Corbin, Paterson, N. J.; E. J. Leavy, F. B. Mullaby, B. F. Currier, Joseph F. Leavy, John J. Healy and A. E. C. King, New York City.

THE WEST ONEONTA & LAURENS RAILROAD COMPANY, Oneonta, N. Y., has been incorporated to construct an electric road between the two places named. The directors are Frank Gould, Parker Wilson, A. D. Gutman and others of Oneonta, and David S. Peet, Peter Seeber and Philip K. Strong, of Laurens. The capital stock of the new company is $75,000.

THE BUFFALO VALLEY RAILWAY COMPANY, Buffalo, N. Y., has been formed to construct an electric surface line from Buffalo to Java, Wyoming County. Capital stock, $350,000. The directors are Luther S. Bent and Felton Bent, Philadelphia; Mason D. Pratt and Edgar C. Felton, Steelton; Herbert P. Bissell and K. Henry Metcalf, Buffalo; Joseph R. Foard and Fred W. Wood, Baltimore, and Benjamin Watson, of Strykerville.

THE TELEGRAPH AND TELEPHONE.

FOND DU LAC, WIS.—The Wisconsin Telephone Company will build a new line from Fond du Lac to Dartford, by way of Ripon.

BELTON, TEX.—The telephone line from Longview to Carthage, which is now in process of construction, has reached Easton.

CHIPPEWA FALLS, WIS.—The Wisconsin Telephone Company is making arrangements to put in a long distance line between this place and Stevens Point.

MANKATO, MINN.—The Blue Earth Valley Telephone Company is extending its lines to various points, and Amboy and Mapleton will each have an exchange.

TECUMSEH, NEB.—The Home Telephone Company will be organized in this city in the near future. It proposes to make connection with the International Telephone Company.

WASHINGTON, IND.—A telephone line is to be erected between this city and Glendale, and from there to Corning. The completion of this line will give telephonic connection with nearly all the towns in the county.

MINNEAPOLIS, MINN.—The backers of the Independent Telephone Company announce that they have secured 2300 subscribers, and will commence stringing their wires as soon as the frost is out of the ground.

STAPLEHURST, NEB.—The Nebraska Telephone Company proposes to extend its wires from Seward to this town. The line will also be extended to Ulysses, and connections will eventually be made with Omaha, Lincoln and other cities.

HENDERSON, KY.—The Cumberland Telephone & Telegraph Company has given a mortgage for $1,000,000 to the Washington Trust Company, of New York. The company will issue bonds of the denomination of $1000, with 5 per cent. interest, and payable in 1918.

CHATTANOOGA, TENN.—The long-distance line of the East Tennessee Telephone Company has been finished as far as Dayton, and this place, together with others, is enabled to communicate with Chattanooga. From Dayton the line will be extended through to Harriman.

PAWNEE CITY, NEB.—The Pawnee City Telephone Company has closed a contract with the National Automatic Telephone Company, of Salina, Kan., for the construction of an exchange in this city, with automatic switchboard. One hundred instruments will be used at the start.

VOLGA, S. DAK.—The telephone company which has its headquarters in Pipestone, Minn., proposes to build its line along the Burlington road northward, and along the Northwestern from Elkton as far west as Lake Preston, where it will connect with other lines; also a line up the branch to Watertown.

WOLCOTT, IND.—It is understood that the Goodland Telephone Company has been reorganized under the name of the Western Indiana Telephone Company. This company has bought the Fowler exchange. Fowler is the county seat. The lines have been stretched to nearly all the towns in this part of Indiana.

HELENA, MONT.—The Rocky Mountain Telephone Company's line between Helena and Livingston will be completed, a contract for that purpose having been closed within the past few days. Another contract was made for the construction of a line between Wallace, Idaho, and Missoula, Mont., thus completing the Helena-Spokane line.

STELLA, NEB.—The Falls City Telephone Company is erecting poles on its new line between here and the county seat. The Auburn Telephone Company will extend its lines from Howe to connect with the Falls City line at this place. The Nebraska Telephone Company has also made arrangements to enter this city within the next thirty days.

MACON, MO.—The Union Telephone Company has been organized at Economy, Mo. It will extend its line to Macon, La Plata, Atlanta, Redmon and Sue City. Construction work will begin at once. The following named gentlemen are officers of the company: Dr. J. N. Southern, president; E. E. Hales, secretary; Joseph H. Grady, treasurer.

SWEETWATER, TEX.—Messrs. Neblett & Cox, of this city, have closed a contract for the construction of a telephone system in this place; also to build a line to Roby and a local system to be established in that town. The line will also be extended to Snyder. Another line is to be strung running from Sweetwater, northeast 45 miles, to Anson, thence to Jacksboro and Decatur.

COLUMBIA, MO.—Messrs. J. A. Hudson and Thomas Cary, of Macon, have bought the Columbia telephone exchange and the People's Telephone Company. They will consolidate the two and extend the lines to other cities. This terminates the telephone war which has existed in this place for several weeks. The rates will remain $12 a year for dwellings and $24 for business houses.

BOSTON, MASS.—The Bell Telephone Company instrument statement for the month ended March 20 shows gross output of 28,909, and the net 13,172, 15,737 having been returned. As compared with the previous year the gain is 475 instruments. It is stated that the number of instruments returned during the month stands as the highest record, the nearest approach to it being 12,790, returned in February this year.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company is extending the use of telephones along its road. Telephones are to be placed at all the bridges and railroad crossings over which the tracks pass, so that in case of delays of any kind the conductors of detained cars may notify headquarters and await instructions. There will probably be 300 telephones in use on the company's system when the improvements are completed.

FORT DODGE, IA.—The business men of this place have just organized the Fort Dodge Telephone Company. The new company has purchased the rights and interests in the company of the same title organized two years ago by various gentlemen of this city. Some of the foremost business men of the city are identified with the new enterprise, which will be placed on a sound financial basis. A first-class, up-to-date plant will be established, and long-distance instruments will be used. The new company proposes to charge $2 per month for business 'phones and $1 for residences.

ELECTRIC LIGHT AND POWER.

DETROIT, MICH.—Richmond at its recent charter election voted to bond itself in $9000 for an electric lighting plant.

GREENVILLE, MISS.—A special election will be held to decide the question of issuing $30,000 in bonds for a municipal electric lighting plant.

MILWAUKEE, WIS.—An electric light plant is to be erected at Elkhart Lake this spring by a Milwaukee firm. Mr. Gottfried is the chief promoter.

LOS ANGELES, CAL.—Ventura will raise $20,000 by the issuance of forty-year bonds to erect an arc and incandescent light plant to be owned and operated by the city.

LAWRENCE, MASS.—The Council has unanimously adopted a resolution favoring the municipal ownership of the electric lighting plant, and arranging for the submission of the question to the voters.

BRADFORD, VT.—A charter has been issued to the Bolton Falls Electric Company, with a capital of $75,000. It controls the water privilege at Bolton Falls, and will build a plant to supply Waterbury with light and power.

FORT WAYNE, IND.—Proceedings have been instituted at Goshen to enjoin the city officials from contracting for an incandescent light plant, bids for which will be opened shortly. It is claimed that the city already exceeds the constitutional limit of indebtedness.

STUTTGART, ARK.—Mr. Charles Williamson, of this place, has been granted exclusive franchises for water and electric light works in Stuttgart. He has incorporated a company, with a capital of $10,000, and will put in the water works at once and the electric lights during the summer.

SARATOGA, N. Y.—A judgment for $280,686, with interest from January 25, 1898, has been entered against the Saratoga Gas & Electric Light Company, in favor of the New York Security & Trust Company. The proceeds of the sale of the plant and business will be divided equally between the holders of the 300 bonds of the mortgage foreclosed.

TAUNTON, MASS.—The municipal lighting plant has been obliged to refuse the request of the Atlas Tack Company for electric power, because it cannot be furnished by the plant. If electric power is required under the present conditions those desiring it must put in plants or the municipal plant must be enlarged. It is understood that $10,000 would enlarge it to a certain

extent, but $25,000 would be better. Perhaps that is why the City Council is holding so tenaciously to the money in the treasury—to make another municipal station with it.

MANCHESTER, N. H.—The electric companies of the region about Lancaster are to be consolidated, under the name of the Northern Electric Company. It will take in the Lancaster, Jefferson, Whitefield and Bethlehem companies. The capital stock will be $100,000. The main power house will be at Bethlehem, and the offices and headquarters at Lancaster.

The Electric Railway.

WORCESTER, MASS.—The Taunton Aldermen have granted a franchise to the Providence & Taunton Street Railway Company.

BALTIMORE, MD.—A company is to be organized at Frederick to build an electric road from that city to Thurmont and Emmitsburg, with a future extension to Gettysburg, Pa.

NEW YORK CITY.—The Assembly at Albany has passed the Eldridge bill prohibiting the use of transfer tickets on street surface lines by others than those to whom they are issued.

BALTIMORE, MD.—Work has begun on the improvements at Point Breeze by the City & Suburban Electric line. About $60,000 will be expended in the erection of a casino and boat house.

BALTIMORE, MD.—The Baltimore City Passenger Railway Company has awarded the contract for the construction of twenty new open cars to the American Street Car Company, of St. Louis.

NEW YORK CITY.—The Saddle River Traction Company has secured the necessary franchise to construct an electric road between Garfield and Lodi, N. J. The line can be put in operation by July 1.

QUINCY, MASS.—The proposed Summer Street, East Taunton, railroad will be built by the Shaw Syndicate Company, and operated by the present stockholders. Sooner or later it is proposed to build to Middleboro and erect a power house.

TIFFIN, OHIO.—Samuel B. Sneath, builder of the Tiffin & Fostoria Electric road, has transferred the line to a company, which will make arrangements to connect with other electric roads in the northern part of the State, and in this manner reach Toledo and Cleveland.

ELKHART, IND.—The Elkhart & Goshen Electric Street Railway Company contemplates equipping its line with a private telephone system. It proposes to furnish each car with an S-C box telephone that can be connected with the office line by plug boxes placed in series at intervals along the road.

NEW YORK CITY.—The New York, New Haven & Hartford Railroad Company has decided to build an extension of its Nantasket Beach electric system between East Weymouth, the present terminus, and Braintree. With the completion of this extension the company will have 15 miles equipped with electricity.

NEW YORK CITY.—The E. P. Allis Company has obtained a contract from the Metropolitan Traction Company for six 6000-hp vertical engines of the Reynolds-Corliss type. The amount involved is $500,000. The engines, which will be constructed in Milwaukee, will form part of the equipment of the power house of the Metropolitan Traction Company, which will be the largest in the world.

CHICAGO, ILL.—The Chicago Electric Traction Company has taken possession of and is now operating the storage battery road, formerly known as the Englewood & Chicago. The new company will issue $270,000 of first mortgage bonds, which will go to the holders of the old Englewood & Chicago bonds at par in proportion to their old holdings, and $900,000 of consolidated mortgage bonds and $1,800,000 in common stock.

NEW YORK CITY.—The Kings County Traction Company will hold a meeting April 11 to vote on a proposition to dissolve. The capital of the company is $4,500,000. It is said the Nassau Electric Railroad Company, which is the lessee of the Traction Company, and through it of the Atlantic Avenue Company, will issue in place of the Traction Company stock $6,500,000 of preferred 4 per cent. stock, and $7,000,000 of common stock.

DULUTH, MINN.—According to a decision of Judge Moer, of the District Court, the County Auditor cannot place public corporation franchises on the personal tax rolls. This decision was in a test case brought against the Duluth Street Railway Company in 1896. The franchises have been taxed each year since, and the decision, if affirmed on appeal, will affect thousands of dollars in the aggregate, for all the corporations in the city enjoying municipal grants have been taxed.

BALTIMORE, MD.—The Baltimore Trust & Guarantee Company, representing a syndicate of Baltimore and New York capitalists, has purchased three street railway lines and two electric plants in Knoxville, and will consolidate them. This deal gives the syndicate control of all the street railway lines in the city. Mr. Frank Hambleton will probably be elected president of the company, and C. C. Howell, of Knoxville, vice-president and general manager. It is proposed to issue bonds to the amount of $850,000 to reimburse those who advanced the money for which to pay for the properties, and provide for extensions and the purchase of new equipment. The bonds will bear interest at the rate of 5 per cent., and will be secured by a first mortgage.

Trade Publications.

THE WALKER COMPANY, in Circular No. 1069, dated March 22, 1898, describes its electric railway generators. The features of construction of these machines are clearly brought out, and the various elements well illustrated. Dimensional data are given in tabular form and diagrams. Views of several plants equipped with Walker machines are also shown.

THE BENNETT AMALGAMATOR MANUFACTURING COMPANY, Denver, Col., describes at length in a recently issued eighty-page pamphlet the Bennett system for placer and river-bed mining. This company manufactures the Bennett electrically operated shovels, dredges and amalgamators, which system was fully described in The Electrical World of March 5. Considerable information on mining in general is also given.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, Cincinnati, Ohio, has issued a new bulletin descriptive of its engine-type, direct-connected generators. These generators may also be direct connected to gas engines. Among the illustrations is one showing the Bullock generator connected to a Westinghouse engine; also a Bullock generator driven by a Forbes engine. The Bullock Company expects to publish in the course of a month another bulletin to be devoted to motors for machine tools and other power work.

THE GENERAL ELECTRIC COMPANY supply department, Schenectady, N. Y., has combined artistic taste with business effort in its recently issued fan motor catalogue. The catalogue is produced in the antique style and is decidedly attractive. It is printed in two colors, and briefly tells the trade what the General Electric Company is doing to make humanity comfortable during the coming summer. In it are found illustrations and descriptions of alternating and direct current fan motors of different sizes, together with price list of the same. This season's machines, of both classes, embody every valuable improvement, and are well finished.

THE LUNDELL FAN MOTOR catalogue just issued by the Sprague Electric Company, New York, is a very attractive one. In it the Lundell motors in their various forms are briefly described and well illustrated. The machines listed embrace direct-current desk fan outfits, bracket motor fan outfits, suspended outfits, ceiling fan outfits of various styles, electrolier ceiling fan outfits, column fans of various styles, alternating desk and bracket fans. On two pages are given illustrations of the parts of the one-twelfth and one-sixth horsepower motors. The catalogue is printed on heavy plate paper, and with its emerald green cover printed in red and gold makes a very handsome appearance.

"SCIENCE ABSTRACTS" is the title of a new monthly publication in London, the first number of which was issued in January this year. It is in magazine form, and gives abstracts of the principal articles in physics and electrical engineering published in the technical press throughout the world. "Science Abstracts" is issued under the direction of the Institution of Electrical Engineers and the Physical Society of London. Mr. J. Swinburne is the editor. The list of abstractors (of which there are thirty-five) includes many well-known names. The abstracts are arranged under the general headings: General Physics, Light, Heat, Sound, Electricity, Electro-Chemistry and Chemical Physics, General Electrical Engineering, Dynamos, Power Distribution, Traction and Lighting and Telegraphy and Telephony. The abstracts bear evidence of careful work, and the references are complete. Each abstract is signed by the initials of the abstractor.

THE DIEHL MANUFACTURING COMPANY, Elizabethport, N. J., is not behind its competitors in the fan motor business. Its 1898 fan catalogue shows a line of interesting machines of various types and finishes. These include ceiling fans, column fans, electrolier column fans, counter column fans, desk fans, bracket fans and exhaust fans. The Diehl column and ceiling fans are very popular machines. The desk fan was placed on the market last season and met with a very flattering reception in the trade. The armatures are built of laminated iron assembled on steel shafts, the coils being wound with double silk covered wire; the commutators are cut from one piece of pure copper and insulated with India mica; the bearings are made of Tobin bronze, are self-aligning and are lubricated by means of wick oilers; the switches and speed regulators are mounted on steel frames, and the finished motors are as complete in all respects as 5-hp machines of the most improved type. The fan is furnished in two sizes, with blades 12 or 16 inches in diameter, and equipped with three-speed switches.

Trade and Industrial Notes.

PATENTS IN TURKEY can be taken out through the aid of Mr. Alfred Bomsel, who has established a patent solicitor's office in Constantinople.

THE STANDARD THERMOMETER & ELECTRIC COMPANY, Peabody, Mass., has appointed the Electrical Exchange, Chicago, as its Western agent.

THE WARREN-MEDBERY COMPANY, Mechanicville, N. Y., is manufacturing the "Improved Warren Inductor Alternator." Its works are at Sandy Hill, N. Y.

MESSRS. E. B. LATHAM & CO., 136 Liberty Street, New York, Eastern sales agents for the Tuerk alternating ceiling fan, state that the orders received so far this year for these fans by far exceed those at the corresponding time last year.

WESTINGHOUSE ENGINES FOR THE KLONDIKE.—An order has been placed by the Moran Brothers Company, Seattle, Wash., for twelve Westinghouse engines for the electric lighting plants on a line of steamers being built for the Yukon River trade.

MESSRS. WARREN WEBSTER & CO., Camden, N. J., have just been awarded the contract for the use of the Webster system by the Hudson Electric Light Company, Hoboken, N. J., to supply steam heat for eleven model tenement houses, 1500 feet from the power house.

MR. A. O. SCHOONMAKER, 158 William Street, New York, is making a full line of mica washers, bushings and tubing of any size and thickness, and will be pleased to send samples to anyone wishing to give them a trial. These goods are in demand by lighting stations for repairing arc lamps.

THE JERSEY ELECTRIC COMPANY, Newark, N. J., is the title of a concern recently incorporated under the New Jersey State laws for the purpose of buying, selling and renewing burned out incandescent electric lamps. The company will use cellulose filament in its product. It will guarantee all renewed lamps, and is prepared to execute all orders promptly.

THE NATIONAL GOVERNMENT is considering the question of equipping every fortification along the Atlantic and Gulf States with searchlights, and, it is stated, has been in correspondence with the General Electric Company on the subject. It is stated that every fortification could be supplied with a searchlight equipment, including dynamo, within four months.

THE DECKER AUTOMATIC TELEPHONE EXCHANGE COMPANY, Owego, N. Y., has purchased the entire stock, plant and business of the Decker-Hinckley Electric Manufacturing Company. The Decker Automatic Telephone Exchange Company was incorporated in New Jersey with a capital stock of $100,000. It will continue the manufacturing business of the concern which it succeeds.

MESSRS. McCARTHY BROTHERS & FORD, Buffalo, N. Y., have been appointed agents in that city for the Sprague Electric Company, of New York City. Other agents appointed are Morton, Reed & Co., Baltimore, Md.; Walker & Kepler, Philadelphia, and Pettingell-Andrews Company, Boston. The Sprague Electric Company is meeting with considerable success in placing its Lundell horseless carriage motors on the market. Quite a number of these machines are used in this country, and very many abroad, particularly in England.

SEALED PROPOSALS will be received by the clerk of the Board of Public Works, Columbus, Ohio, until noon, April 13, for furnishing the labor and materials for the construction of an electric light plant for the city of Columbus in accordance with the plans and specifications on file, and to be obtained from H. M. Lyman, superintendent of lights, Columbus, Ohio. The apparatus and materials needed will include two compound condensing engines, two water tube boilers, four arc dynamos, two water wheels, arc lamps, poles, wire, etc. Mr. James A. Fanning is the city clerk.

BALL ENGINES, manufactured by the Ball Engine Company, Erie, Pa., are being installed by the Jones Brothers Electric Company, Cincinnati, Ohio, in the New Electric & Gas Light Company's building, Guthrie, Okla., and in the Horne Building, Pittsburg, Pa. In the first-named plant a 250-hp tandem compound engine will be direct connected to a 150-kw Westinghouse dynamo. In the Guthrie plant a 175-hp engine, also a boiler and heater, will be placed, and in the Horne Building two vertical cross compound engines are being installed, being direct connected to Siemens & Halske generators.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, reports that since the first of the year it has received orders for ninty-five machines, and that its business is very satisfactory. Between March 1 and 15 the company sold motors aggregating 197½ horse-power, and generators with an aggregate capacity of 126 kilowatts. Among these may be mentioned the following: The Electrical Supply Company, Madison, Wis., one 5-hp, 500-volt, moderate speed motor; Chicago Light, Heat & Power Company, two 100-kw, 125-volt, moderate speed generators, and one 30-kw, 225-volt, moderate speed generator for the Peninsular Light & Power Company, Orlando, Fla. The company also sold a marble switchboard.

MESSRS. J. JONES & SON, New York, manufacturers of electrical supplies, will on May 1 move their quarters to 64 Cortlandt Street, in the building now occupied by the Manhattan Rubber Manufacturing Company. This change is rendered necessary on account of the increase of the firm's business, particularly since it commenced to manufacture electrical apparatus. The firm will occupy the entire building, which has four stories and basement. The entire floor surface is 6000 square feet. The salesroom and wholesale storeroom will be located on the ground floor, and the offices will occupy the second floor. The other floors will be used as stock rooms. The firm of Messrs. J. Jones & Son is one of the most popular in the electrical trade in this city, its popularity being due largely to its progressive and courteous manager, Mr. E. A. Lowe.

THE REPRODUCTION OF PHONOGRAPH RECORDS.—The American Graphophone Company, of which the Columbia Phonograph Company, 11 Broadway, New York, is the sole sales agent, has recently obtained an order from Judge Wheeler, in the United States Circuit Court for the Southern District of New York, adjudging Cleveland Walcutt and Edward F. Leeds guilty of contempt in connection with an injunction that had been issued, enjoining them from making or selling music and other sound records for talking machines, in violation of the patents of the company. After the injunction had been granted the defendant firm went out of existence, and was succeeded by the Walcutt & Leeds Company, Limited. Judge Wheeler has decided that this is a violation of the injunction and contempt of court. Under the order the defendants are not permitted to combine the machines sold them by the American Graphophone Company with any other device so as to produce duplicate records.

THE C & C ELECTRIC COMPANY, New York, reports that the month of March was one of the busiest and most satisfactory in the company's experience, and that in that month it received some of the best orders that it has booked for some time, some of them being for large quantities of special machines, including one from Capt. Sam Brown, the Pittsburg "Coal King," for twenty-five 15-hp special motors to operate coal cutters. The company's new office in Pittsburg is now under the management of Mr. G. F. Woolston, and a gratifying trade for C & C apparatus has been built up in that section. The company's new office in London is also very active, and some large orders have recently been taken there. It is stated that English machinery manufacturers seem to have taken a great fancy to the C & C closed type ironclad motors, and during the last few weeks orders have come in from this quarter for some twenty of these motors. The C & C Company's factory at Garwood, N. J., continues to run night and day.

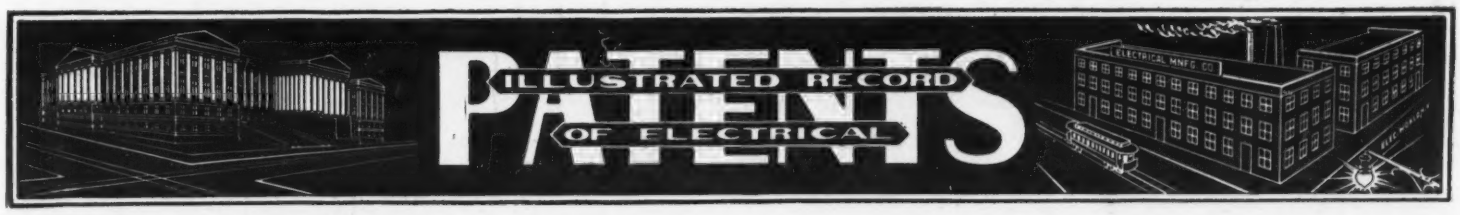
THE KINLOCH TELEPHONE COMPANY, of St. Louis, is well known all over the country as operating one of the most extensive telephone exchanges in America. Its stockholders comprise some of the best-known business men of St. Louis. The Kinloch Company, after making numerous tests, has recently closed a contract for a year with the Phœnix Carbon Manufacturing Company, of the same city, for all the batteries and component parts for use in its exchange. The Phœnix Carbon Manufacturing Company is to be congratulated on this order, and especially in view of the determination of the Kinloch Company from the very start to use the best of everything it bought, and the size of the order naturally induced considerable competition. But the Kinloch Company decided that the Phœnix No. 1 carbon porous cup cell met all requirements. The Phœnix Carbon Manufacturing Company has recently made extensive improvements and largely increased its facilities, and is now in a position to deliver batteries of this or any other type in quantity, and to guarantee its product in all departments to be the highest in quality, although sold at reasonable prices.

THE WALKER COMPANY reports the following among the foreign orders recently received: Twenty double No. 3-S street car equipments, three single No. 3-S equipments and eighteen double No. 3-N equipments for Poris, beside four 150-kw belted generators and two generator panels. Messrs. Bagnall & Hilles, of Yokohama, have ordered two 25-kw direct connected generators for Singapore. Recent domestic orders include two 150-kw, three-phase synchronous motors for the Lachine Rapids Power Company, a 700-kw alterntor, single phase, for the Buffalo & Niagara Falls Electric Light & Power Company, two 400-kw, belt-driven generators for the Syracuse Construction Company, and one 120-kw belted generator for the Northern Electric Company, Baltimore. The Norton & Attleboro Railroad, of Attleboro, Mass., has purchased four double No. 4-A-S and two double No. 5-S equipments, beside a 250-kw direct connected railway generator. Beside the generator above referred to the Northern Electric Company, Baltimore, has ordered 100 Walker arc lamps, making in all 320 ordered in three months. The company has also recently taken a contract from the Government to build three disappearing gun carriages for 8-inch rifles. They are to be of the Crozier type, '96 model.

THE GENERAL ELECTRIC COMPANY, in view of the constantly growing demand for its apparatus, has decided to make a large increase in its manufacturing facilities. March 25 the company placed contracts for the construction at its Schenectady works of a new foundry, which will be one of the largest in this country. The building will be of brick, 500 feet long and 140 feet wide, with an "L" 100 feet by 120 feet. The latter will be used as a cleaning shop. Beside these main buildings a number of sand sheds, several smaller buildings for the storage of foundry material, and a new pattern store house 200 feet long, 60 feet wide and two stories high, will also be erected. All combined, the floor space occupied will be about 12,000 square feet. Plans are also under consideration for a new machine shop 650 feet long by 165 feet wide, but the appropriation for this has not yet been authorized. The contemplated machine shop will be built on Central Avenue, opposite building No. 15, and will be devoted almost entirely to very large machine work. The size of the great generators which the General Electric Company has been manufacturing has of late been increasing, until to-day a generator of 4000 horse-power is not regarded as of unusual size. In fact, generators of 5000 horse-power are now in course of design, and the demand upon the shop in which the large machinery has heretofore been built has far outgrown its present proportions. The middle aisle of the new machine shop will be 65 feet wide, with narrower aisles down each side. Electric traveling cranes will be installed to operate along each aisle and a gallery will be built along one side only. All the large machine tools will be removed from their present locations to the new shop, their places being taken by smaller apparatus. The total floor space of this building will amount to not less than 144,250 square feet.

Business Notice.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York City.



UNITED STATES PATENTS ISSUED MARCH 29, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

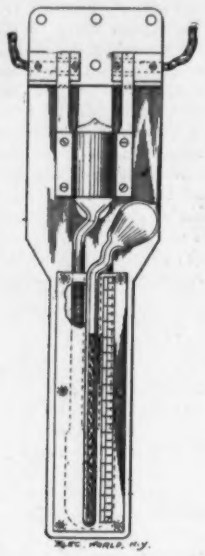
601,233. SYSTEM OF ELECTRICAL DISTRIBUTION; W. L. Bliss, Brooklyn, N. Y. App. filed Oct. 14, 1897. Method of controlling the current and E. M. F. of a dynamo, consisting in demagnetizing the field of said dynamo, as the speed and E. M. F. of said dynamo increase, by means of an auxiliary counter E. M. F., which increases as the speed and E. M. F. of said dynamo increase, and which is connected in series with the primary exciting field coil of said dynamo.

601,256. MAXIMUM METER; A. H. Hoyt, Penacook, N. H. App. filed July 29, 1897. In a thermal registering maximum meter, two strips of thin metal covering opposite sides of the heating area of the thermal tube and electrically connected in parallel, and similarly connected to the stationary and movable parts of the instrument.

601,263. COMBINED RAIL JOINT AND BOND; H. R. Keithley, New York, N. Y. App. filed March 29, 1898. A combined rail joint and bond, comprising a single metallic piece forged around the meeting ends of two rails, and a bonding plate interposed between the rails and joining piece.

601,268. ELECTRIC ARC LAMP; P. F. Krug, New York, N. Y. App. filed Jan. 7, 1897. In an electric arc lamp, the combination with a supporting stand, of a supporting arm provided with a movable fulcrum bearing against said stand, carbon holders, means for supporting and adjusting the carbon holders, and means for setting and adjusting said supporting arm and its fulcrum.

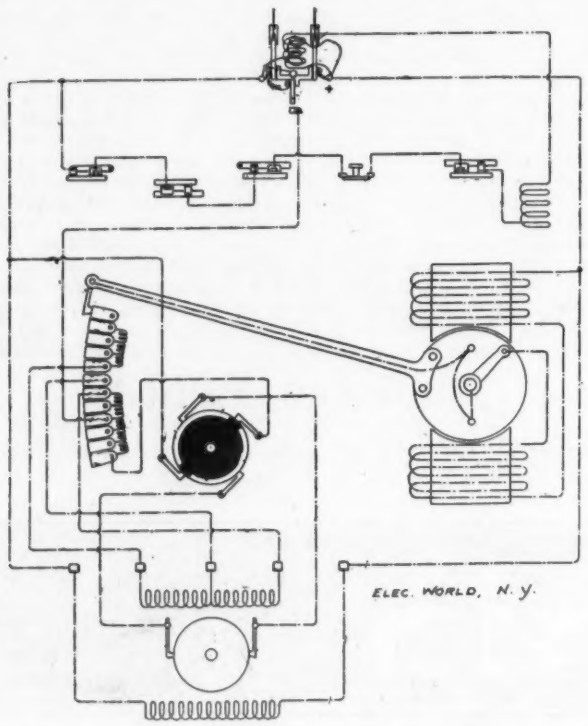
601,276. ELECTRIC SWITCH; O. S. Platt, Bridgeport, Conn. App. filed Feb. 2, 1897. In an electric switch, the combination of a base portion provided with circuit terminals, a movable contact bar arranged by its movements to electrically connect and disconnect the terminals, independent spring mechanisms, one normally under compression and the other relatively normally uncompressed, and releasing the compressed spring to throw the contact bar into and out of engagement with the terminals.



No. 601,256.—Maximum Meter.

601,286. FUSIBLE CUT OUT; F. Schwedtmann, St. Louis, Mo. App. filed May 6, 1897. In a fusible cut out, a suitable box or casing of insulating material, line wire terminals carried thereby, a removable fuse carrying member in said box or casing, fuse terminals carried by said fuse carrying member and adapted to be put into electrical communication with said line wire terminals, and a removable protecting cover for said line wire terminals at the side of the casing opposite said fuse carrying member.

601,301. SAFETY DEVICE FOR ELECTRIC ELEVATORS; J. D. Ihlder, Yonkers, N. Y. App. filed Oct. 15, 1896. In an electric elevator, the combination with the car and motor therefor, of a potential switch arranged in the circuit of the motor, and a shunt circuit, including the magnet of the potential switch and the magnet of the safety brake device.



No. 601,301 —Safety Device for Electric Elevators.

601,351. ELECTRIC LIGHTER FOR GAS BURNERS; L. V. Lewitzki, Brussels, Belgium. App. filed April 15, 1897. In a gas lighter, the combination with the burner, of a magnet, a valve for admitting gas to the burner, means actuated by said magnet for opening and closing the valve, an electric igniter for the burner, an electric circuit including the magnet and the igniter, so that the latter is energized only while the circuit of the magnet is closed, and an auxiliary valve connected to and operating with, but in opposition to, the main valve, for reducing the area of the passage opened by the latter while the circuit is closed, and thereby diminishing the flow of gas to the burner during said period.

601,396. CATAPHORIC ELECTRODE SUPPORT; M. W. Hollingsworth, Philadelphia, Pa. App. filed Nov. 24, 1897. In a cataphoric electrode support, the combination of the interdental clamp, means for operating said clamp, and an electrode holder adjustably connected to said means.

601,412. WIRE HOLDER; F. Canfield, Boulder, Col. App. filed Oct. 23, 1897. A wire support consisting of the combination of a link or hanger, a saddle piece provided with jaws adapted to be adjusted on said link, and a key piece for clamping and holding the rod or wire within the jaws of the saddle.

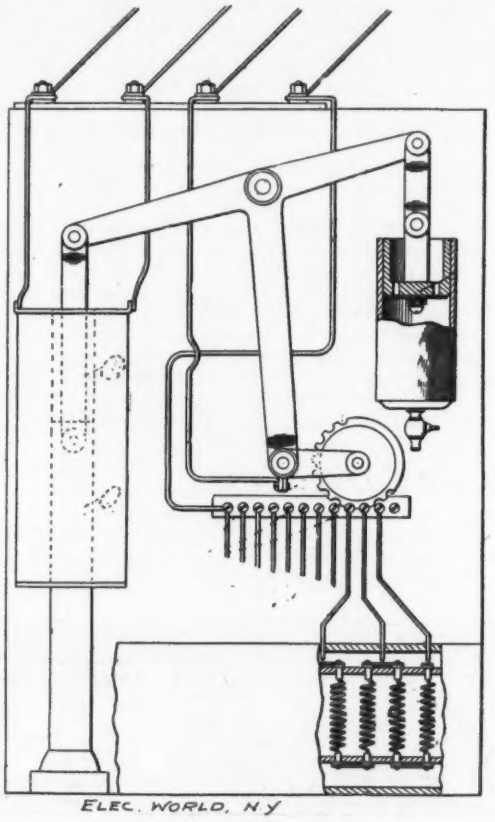
601,454. CLAMPING BUCKLE FOR ELECTRIC LINE WIRES; A. H. Weikman, Palmyra, N. J. App. filed Dec. 8, 1897. In a buckle for attaching electric line wires to insulators, the elastic fulcrum wire adapted to embrace an insulator and having open projecting ends, in combination with a lever pivotally connected therewith, and a clamping bail adapted to bend the line wire over the projecting ends of the fulcrum wire and bind the line wire to the insulator.

601,458. ELECTRIC RAIL BOND; F. W. Atkinson, Chicago, Ill. App. filed Oct. 4, 1897. An electric rail bond, consisting of two or more strips or wires which are bent together into two angles to approximate the form of the letter Z, and terminally held together in the same plane by securing rivets.

601,471. STORAGE BATTERY; C. S. Kaufmann, Chicago, Ill. App. filed Sept. 4, 1897. In a storage battery cell, the combination of plates, insulating supports arranged between them and provided with longitudinal channel or channels, and pins formed of insulating material projecting from the faces of some of the plates, with their ends received into the grooves or channels in the insulating supports.

601,482. ELECTRIC RAILWAY SIGNALING SYSTEM; B. Samuels, St. Joseph, Miss. App. filed May 6, 1896. A railway signal, comprising a casing having holes or openings therein, a rod or arm rotatably mounted in said casing, and having discs thereon adapted to normally cover said openings, a magnet and its armature adapted to rotate said rod or arm, an electric circuit adapted to energize said magnet, a hook arm on said rod or arm adapted to open the circuit to said magnet during the rotation of said rod or arm, and means for holding said discs away from said openings, whereby said circuit is kept open.

601,492. AUTOMATIC CUT OUT; H. F. Blackwell, Jr., Brooklyn, N. Y. App. filed Aug. 28, 1897. An automatic cut out for an electric circuit, comprising a spring actuated arm forming a conductor, a link connected at one end to the arm and at the other end to a part insulated from the arm, and a carbon point in the circuit and engaging with the link, and adapted to separate the link when heated by an excessive current.



No. 601,588.—Rheostat.

601,585. ELECTRIC HEATER; J. F. McElroy, Albany, N. Y. App. filed Feb. 14, 1897. In an electric heater, the combination of supporting brackets having square openings therein, a squared spindle carried by said brackets and placed in said openings, a core of insulating material having a square perforation adapted to be placed on said spindle, a coiled resistance on said insulating material, and means for holding the same in position.

601,588. RHEOSTAT; F. E. Pool, Quincy, Ill. App. filed Jan. 31, 1898. The combination of a feed wire terminal, a pivoted lever having one end in engagement with said terminal, stationary contact pins, and a roller linked to said lever and terminal, and adapted to rest on said contact pins.